LECTURES,

IN CONNECTION WITH

THE EDUCATIONAL EXHIBITION

OF THE

Society of Arts, Manufactures, and Commerce,

DELIVERED AT

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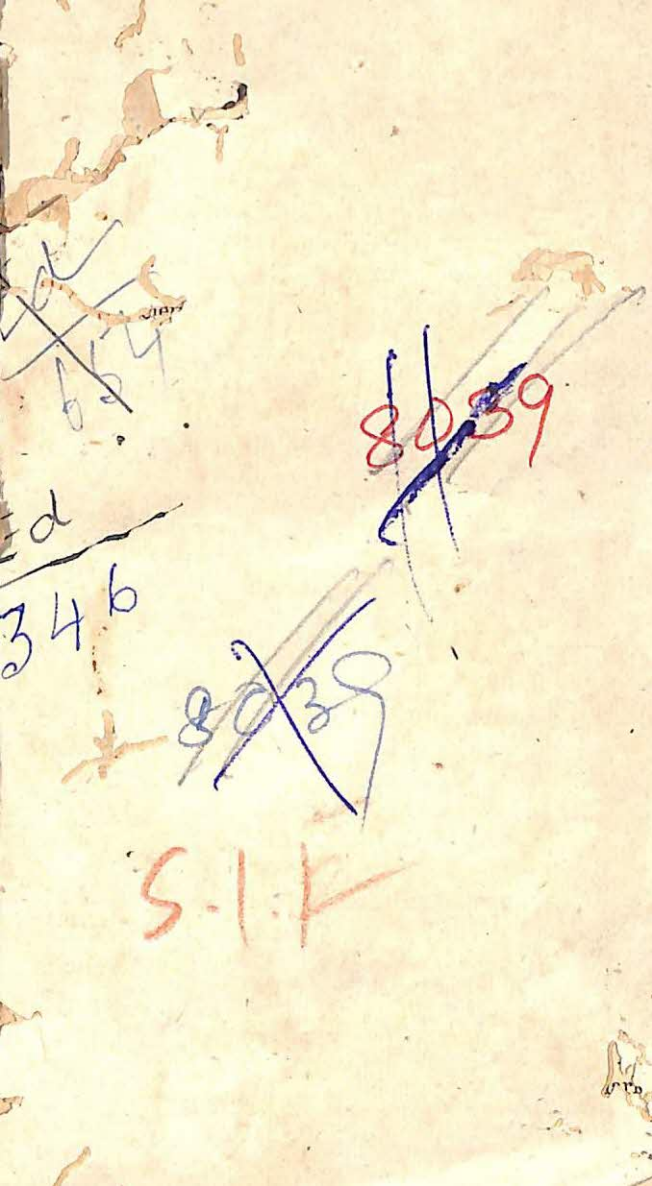

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PREFACE.

THE Society for the Encouragement of Arts, Manufactures, and Commerce, has always aimed at the promotion of Education; and rendered some services in this cause before the Educational Societies now flourishing were in existence. Being this year in its One Hundre[HE] Session, the Society was desirous that the celebration of th[at] should be marked by some prominent measures, indica[TING] its settled conviction that it is to an improved Education of all classes that the Nation must principally look for a progressive improvement in its Arts, Manufactures, and Commerce. In May, 1852, under the presidency of the Marquis of Lansdowne, K.G., it was resolved, on the motion of Earl Granville, that the Society should offer to receive into union the Literary and Scientific Institutions, Philosophical Societies, Athenæums, and Mechanics' Institutes, which are established in all parts of the United Kingdom. Three hundred and sixty-eight of these bodies have already been taken into the Union; and, at the Conference of their Representatives, in June, 1853, the Council was particularly invited, and undertook to hold an Educational Exhibition, at the opening of the next Conference, in the present year.

Such was the origin of the Educational Exhibition which has just been held by the Society of Arts, at St. Martin's Hall.

The Council of the Society was desirous that the Exhibition should be complete and instructive; and it was regarded as very important to exhibit, as far as possible, a representation of the means of education in France, Prussia, Belgium, Hanover the German States, Holland, Norway, Sweden, Denmark, Switzerland, and the United States of America, as well as in the

United Kingdom and the Colonies. The Council applied to the Foreign and Colonial Departments of her Majesty's Government, who most readily assisted in making known the object the Society had in view, and in commending it to the best consideration of Foreign States and the Governments of Colonies. The Treasury granted the privilege of admission, duty free, for all articles sent for exhibition and not for sale. Most heartily was the invitation of the Society responded to both at home and abroad, and the Exhibition (the first of the kind ever formed in any country) has been regarded by all concerned or interested in education as most successful.

In connection with this Exhibition, the Council organized a Series of Lectures on subjects rela to education. The assistance of individuals, eminent ir talents and zeal in the cause, was sought and obtai nd every Lecturer gave his services gratuitously. During the period that the Exhibition was open, lectures were delivered once and very frequently twice a day. Many of these lectures were delivered either from scanty notes or none at all, and it is to be regretted that no record of them remains. The present volume contains such as the authors had either previously written or have subsequently prepared from their notes, and have kindly and generously placed at the disposal of the publishers.

The Council of the Society, in giving its sanction to the publication of the present volume, is in no way committed to the views or opinions of the Lecturers. It must be remembered that in seeking their aid, the Council did not confine itself to one particular sect or party. It desired that all should be represented, and have the opportunity of explaining their views. One condition only was imposed, and in every instance it was strictly and cheerfully adhered to, viz. that religious and political topics should be carefully excluded.

LIST OF LECTURES.

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THE RELATIONS OF BOTANICAL SCIENCE TO THE OTHER BRANCHES OF KNOWLEDGE.

By ARTHUR HENFREY, ESQ., F.R.S., F.L.S., *&c., Lecturer on Botany at St. George's Hospital.*

THE classification of the sciences, and the investigation of their relations one to another, must necessarily be a subject of great interest to those who pursue the special branches of knowledge in a philosophical spirit, not as the means of acquiring a body of abstruse ideas, but for the purpose of contributing to the common stock of classified facts and natural laws upon which the education, and consequently the civilization, of the human race depends.

A votary of the Natural History sciences is especially led to the examination of the general relations of his pursuits, from the great degree in which they seem to the common observer to be removed from the practical business of life. It is a question to which his social and sympathetic feelings especially attract him, and, therefore, it is with great gratification that I avail myself of this opportunity of insisting publicly upon the claims of Botany to the attention of all engaged in education.

The most remarkable of the classifications of the sciences which have been given to the world, may be briefly characterized by arrangement under three heads, indicating the totally distinct points of view from which they set out, viz:—

1. Those based upon the sources of knowledge.
2. Those based upon the purpose for which the knowledge is sought; and
3. Those based upon the nature of the objects studied.

1. The classifications of the first kind,—those which arrange the various branches of knowledge, according to the character of the intellectual methods and processes by means of which they

are cultivated, are termed subjective, as regarding alone the nature of the recipient mind or subject.

If we disregard the technicalities of metaphysics, or rather psychology, we may conveniently restrict our analysis of this, to the distinction of two qualities, those of *perception* and *reflection*.

By perception, by the aid of the senses, we observe facts: these facts may be either independent of our influence, when we call the operation *observation* proper; or they may be the result of special contrivance on our parts, when the mode of observation is called *experimentation;* and, again, we may receive information of observed facts, by *testimony* of others. All these processes involve the acquisition of *experience*, direct or indirect, of phenomena; the sciences pursued especially by their means are called *experimental*, and the truths of experience are *facts*.

Reflection is the action of the reasoning faculty, according to its own laws, upon the simple ideas furnished by perception, dealing with certain properties of these, which it abstracts from the facts of perception, and by the comparison and classification of them, arriving at generalizations, principles, laws, and the like, known by the collective name of *theory*. Those sciences which depend almost entirely (for none do solely) upon the reason, are called *rational, abstract*, or *theoretical* sciences.

Now, when we consider that there exists no science purely abstract from its origin, and that the measure of advancement of every science is the degree to which it has co-ordinated the ideas with which it deals under general propositions and laws, it becomes obvious that the division into *experimental* and *abstract*, is totally inapplicable to the existing state of science.

2. The classifications according to purpose, the division into *speculative* and *applied* or *practical* sciences, fail almost in the same way, since the progression of every science is marked, step by step, by the removal of certain truths from the position of abstract theories, interesting only to the learned, into the rank of axioms from which practical results of the greatest value to mankind are derived.

3. The third point of view is that from which we regard only the objects of our study, without considering either the faculties or processes by which we obtain our knowledge, or the advantages we may derive from its acquisition.

When we reflect upon the ordinary operations of our reasoning faculties, upon the common rules of logic, it becomes evident that this last mode of classification is the only one that can be called *rational*, since it is the only one which proceeds according to the indispensable rule, of advancing from the most simple to the more complex of the ideas which we wish to co-ordinate in

our minds. The other two modes, the division into experimental and rational, abstract and applied sciences, must not only, from their nature, continually shift their ground as knowledge progresses, but they both set out from considerations of a highly complex character, which it would be vain to attempt to analyze until a very large portion of the whole field of human inquiry had been cleared.

The objective mode of classification, which seems to have been first promulgated in a full and adequate manner by Descartes, has been revived of late years from a long oblivion, and it asserts its claim so clearly and evidently, and proves to harmonize so completely with the general direction which scientific inquiry has taken in modern times, that those who have once become acquainted with its characters can scarcely hesitate to adopt it.

The principle is laid down by Descartes in his "Method,"* in the following terms: "To conduct my thoughts in order, commencing with the objects which are simplest and easiest to know, so as to rise gradually to the knowledge of the more compound;" and in a subsequent chapter† he traces the course of his inquiries through mathematics, general physics, botany, zoology, and the sciences relative to man, according to the progressive complexity of the objects of his study.

In the chain or series thus formed, there not only exists a logical sequence, a relation of progression of the number of *kinds* of ideas with which we have to deal, but there is a relation of dependence, insomuch that each science rests upon that preceding it for a certain proportion of its data, and in turn constitutes the necessary basis for that which follows,—added to which we find the history of the development of the individual sciences bringing a striking confirmation of the validity of the principle, by showing that although the first steps were made almost simultaneously in all the great divisions of science here laid down, the most simple have, from their nature, outstripped, in exact proportion to their relative simplicity, those which involve more complicated classes of generalities; so that, as it has been well expressed, the *logical antecedents* have always been the *historical antecedents*.‡

The objective classification of the sciences may be briefly explained here.

The primary divisions depend upon the groups or classes of

* Descartes, Discours, &c., Ed. Aimé Martin, p. 15. Paris, Lefevre, 1844.

† Ibid, pp. 34, 35.

‡ Isid. Geoffroy St. Hilaire, Histoire Naturelle Générale, i. p. 233. Paris, 1854.

truths; which must be arranged according to their simplicity, or what amounts to the same, their generality: in other words, the small number of qualities attached to the notions with which they deal.

The Mathematical Sciences deal with ideas which may be abstracted entirely from all material existence, retaining only the conception of space and number.

The Physical Sciences require in addition the actual recognition of matter or force, or both, in addition to relations in space and time, but they are still confined to *universal* properties of matter.

The Biological Sciences are distinguished in a most marked manner by their dependence; the laws of life relate to objects having relations in space and time, and having material existence; they display moreover in their existence a dependence upon physical laws, which form their medium; but they are distinguished by the presence of organization and life, characterized by a peculiar mobility and power of resistance to the physical forces, and an individuality of a different kind from that found in inorganic matter.

The Sciences relating to Man, to human society, are removed another step, by the interference, among all the preceding laws, of those relating to the human mind in its fullest sense.

We thus obtain four groups. The following table illustrates these remarks:—

Truths	Abstract or absolute	..	Mathematical Sciences.
	Relative	to Matter	Physical Sciences.
		to Life	Biological Sciences.
		to Man	Social Sciences.

These four groups include respectively a number of secondary sciences derived from, dependent on, or forming essential constituents of the groups. With these we shall only so far engage ourselves here as relates to the subdivisions of Biological Science. Certain common characters run through these, life and organization being attributes of all the objects with which they are conversant. Physiology and Morphology traverse the whole field of organic nature, animal as well as vegetable. But as animals and vegetables exhibit, in mass, a manifest difference in the degree of complexity of the vital powers and the organization,—since the animal kingdom exhibits qualities which are superadded to and conjoined with those which it shares with the vegetable kingdom,—it becomes necessary to distinguish the branches of Biology relating to these, and to divide these sciences under two heads, Botany and Zoology.

The greater simplicity of the physiological processes of vegetables, is alone sufficient to indicate their inferiority, or

antecedent position in the scale of natural objects; and this is further confirmed, in accordance with the principle of objective classification, by their greater generality, since they extend through the succeeding group, in the vegetative or organic life of animals, while the animal life proper is restricted to the latter. And this physiological distinction is in agreement with a morphological or anatomical difference, for not only is the apparatus of organic life more complicated in animals, but these possess a system of organs, the nervous system, which is not represented in any way in vegetables, and constitutes the especial instrument or seat of that kind of spontaneity which is the most striking characteristic of animal life.

These observations will suffice to give an indication of the place which Botany holds in the natural classification of the sciences generally, according to the objects of their investigation.

Let us turn now to the *methods* employed in the various sciences, in order to ascertain the relative position of that with which we are engaged, in this respect also.

Those sciences devoted to the investigation of purely abstract truths, the mathematical sciences, are free from the necessity of applying the perceptive faculties or senses, since the objects of their pursuit are ideas from which have been abstracted all qualities having material existence. Those sciences—geometry and algebra—proceed by reasoning, and calculation, which has been well designated an abridged mode of reasoning. When we advance to the examination of material phenomena, the faculties of observation come into play, and in the first place, in application to facts over which we can exercise no control; thus, in astronomy, pure observation is added to the reasoning and calculation used in mathematics. In the investigation of the physical phenomena of our own globe, however, we have greater scope, and are able to prepare facts for observation,—to *experiment*, as it is termed. In the biological sciences, reasoning, observation, and experiment, all have place; but observation of unprepared facts is far more employed than experiment. Observation, however, as used in biology, is very different in its character from observation in physics. Not to speak of the greater complexity of phenomena, increasing in great proportion the danger of errors of sense, or first perceptions, a new difficulty arises from the character of the objects observed. In physics, observation of any given object, a ray of light, a chemical salt, or the like, is sufficient to afford us conclusions as to all existing objects of the same kind: any one specimen will serve as a type of the rest; and a renewal of the observation under precisely the same conditions, will only repeat and verify it. But in the case of animals or plants, no single example will

serve as a *type* of its *kind*. Thus in astronomy a single observed fact becomes a datum, in terrestrial physics any given example of an object may be experimented on, and all the characters of the kind of object ascertained; while in biology, the individual example, transitory and always undergoing change, being incapable of affording at any given time all the characters of its kind, it becomes necessary to derive the specific type, the *permanent unity* as it was called by Buffon, from comparison of a more or less considerable number of examples, of all ages, and placed in all conditions. Here then we are compelled to generalize from the very first step of our progress.

The words light, heat, iron, gold, oxygen, or the like, do not necessarily connote any attribute, imply no classification or grouping of separate things, so that we could not say a light (except colloquially in the sense of a source of light, which would imply a generalization), a gold, an oxygen, &c. But when we speak of a horse, an oak, or any animal or vegetable, we use a general name, connoting certain characters or attributes, belonging to a class of objects, that is, an indefinite number of objects separated by those attributes from all other objects.

Now, as the classes or kinds of objects forming the basis of all reasoning toward laws in Botany and Zoology, exist in enormous numbers, it is evident that *comparative observation*, by means of which the groups are established, must occupy a most prominent place in their processes, since the classification of things is one of the necessary preliminaries to the induction which seeks the ascertainment of law.

In dwelling upon these differences, however, it is important to point out that the methods of all the sciences are fundamentally one, modified only in secondary particulars, and the division of the sciences into deductive and inductive indicates merely a difference in the degree of advancement of the respective sciences towards perfection. Every science is at first inductive, but in proportion to the small number of qualities possessed by its objects, it rises more quickly to certain abstract generalizations, which suffice to represent all the necessary characteristics of its individual objects or unities, and then deduction enables us to derive all the possible conditions of their relations from these. Mathematics have long stood in this position. Physics lagged behind long, from the over haste of the ancients to attain to their generalization, without passing through the series of inductions from facts which were indispensably requisite for the secure foundation of deductive physics. In these days, however, induction having performed a vast amount of work, since Bacon gave the great impulse to its application, deduction finds a large and increasing domain in physics, where observation

is only applied for the purpose of verification. On the other hand, deduction as yet finds little scope in biology, and the attempts of the German "philosophers of nature" are not of a character to attract us to the pursuit of this method; nevertheless, it is evident that when the bases have been securely laid by induction, deduction finds as great a scope here as elsewhere.

A few words must still be added respecting the inductive method in natural history. Bacon* defines induction as "constructing its axioms from the senses and particulars, by ascending continually and gradually till it finally arrives at the most general axioms," and subsequently he warns us against what he calls "anticipations," meaning hypotheses. But however valuable his cautions were in the state of science in those days, it is evident that this precept of avoiding "anticipations" is the advice to abdicate the most valuable attributes of the human mind. Indeed, he remarks in a later passage† that his "method of discovering the sciences is such as to leave little to the acuteness and strength of wit, and indeed rather to level wit and intellect." And those who have possessed acuteness and strength of wit, and who have most advanced the natural sciences since his day, have, in return, departed from this rigorous method of induction, and by this alone rendered possible the rapid progress of their sciences.

For in natural history—to speak of this alone—it is rarely in our power to ascertain *all* the particulars requisite for any given induction—it is scarcely ever possible to use this *demonstrative induction*. We are constantly obliged to derive a general consequence from a portion of the particular cases which it ought to rest upon, and in such cases we *anticipate* the agreement of the rest, basing the hypothesis upon *analogy*—one of the most important instruments in the biological reasonings. In this way we arrive, not at absolute certainties, but at great probabilities, which are then tested by the various modes of verification, before they are admitted into the rank of truths. Thus this reasoning from analogy or *tentative induction*, comes to occupy a front rank with us, and is in reality of far greater utility for the advancement of science than the pure demonstrative induction; at the same time, it is a process which requires to be employed with the greatest circumspection, and under the most rigid control both of observation and reasoning. And this gives the methods of Natural History a high value as intellectual discipline; for the cases in which inductions have to be made, or judgments to be formed in common life, are most frequently of this kind. Of the particulars which will be comprised in our generalization, only a certain number are accessible to observation.

* Novum Organum, pp. 13, 14, 15. Ed. Pickering, London, 1844.

† Ibid, p. 31.

We will now direct our attention to some further considerations regarding the relations of Botany, as one of the biological sciences, to those preceding it in the classification we have adopted. That branch of physics which immediately precedes it is chemistry, the most special of the physical sciences, and its relations with this it will be sufficient for us to examine, among the antecedents.

Chemistry, like the biological sciences, penetrates into the intimate constitution of natural bodies; and moreover, the bodies subject to its domain exhibit a kind of individuality not dependent upon ideas of number, density, colour, &c., alone, but upon this said intimate constitution. We arrive here at the formation of certain abstract notions, for the purpose of classification, which include in the particulars from which they are derived both statical and dynamical characters. These abstractions refer to the idea of a *species*, which however is far more general here than in Botany or Zoology. A species in chemistry is a definite compound of two or more elements, in obedience to certain general laws, possessing certain definite characters by which it may be known from all other species; the relation between the objects represented in this conception is one of identity in all respects but that of simple material continuity: the individuality of separate natural objects belonging to the given species, depends solely upon their being mechanically separated from each other. There do indeed exist *varieties* in chemical species, analogous to the varieties of species in living nature, but these partake of the same unstable individuality, and depend upon physical causes of great generality. Thus the allotropic conditions of some chemical substances, and even perhaps the crystalline or amorphous states of many, may be regarded as varieties of this kind. These species are remarkable, not only from the generality of their nature, but from their immobility; the only possible change in a chemical species, is its conversion into other species, or transformation, in which the relations become entirely changed, and the name altered. There is nothing like development here,—the gradual unfolding, by assimilation and transformation of material received from without.

In the organic kingdoms, the idea of the *species* is an abstraction from very different facts. The objects to which it refers have a separate individuality dependent upon characters non-existent in inorganic bodies. They are incapable of transformation, but susceptible of change according to certain laws; and while the chemical individual is homogeneous, and can only be divided into parts, of which each equally well represents the species, the biological individual is divisible in parts of different kinds, which have relations of harmony and continuity, but by

no means of homogeneity, those parts making up together what constitutes the organism. Thus we see a distinct gradation between chemistry and biology, in reference to the generality of the notion which forms the basis of all classification in each.

In Biology itself we find that the notion of the individual is modified in an analogous manner, when we carry it up from the vegetable into the animal kingdom; at all events, in those subjects of the latter, in which animality is most clearly manifest.

In regard to taxonomy, then, or classification, Botany stands between Chemistry and Zoology.

In reference to the qualities of form, which make their first appearance in minerals, plants show an advance upon the inorganic world, since the angular solid figures, bounded by plane surfaces, subject to the simplest laws of geometry, soon become complicated with figures bounded by curves; and in the plants which produce a stem, the form is dependent upon the properties of spiral curves. In the animal kingdom the bilateral symmetry, which is only traceable in the appendages of the trunk in plants, becomes the general rule, in all except certain of the larger groups; this is manifestly a further departure from the geometrical forms of crystals, and indicates a gradation in advance of the forms of plants; the more especially when we remember that the appendages of the trunk are the organs of nutrition and reproduction, therefore of life, in plants; while in animals, where the vegetative life is subordinate to a higher, these organs are progressively more and more completely hidden and inclosed, and the variations of outward form depend upon a new set of developments of the trunk or central axis, forming the organs of sense and volition, or animal life.

The examination of the outward relations of natural objects leads to the same co-ordination. Mineral or lifeless bodies can only retain their specific identity while at rest, that is to say, chemically; they change in accordance with general laws when brought into contact with each other; and in the change they become transformed into other species. Animal or vegetable, organized or living bodies, constantly manifest action and change; it is in this especially that their life consists, but in so doing, they do not lose their specific identity, but rather unfold and complete the characters of this. The actions performed in the organization are partly of physical and chemical nature, depending upon the laws of these sciences, but are subject to the regulation of a superior power, which guides and directs them, maintaining itself among and through these, but distinct from them. We may compare the position of this vital force of organization to an architect employing a band of workmen to construct a building, he only designing the forms, and leaving

them to find the materials and mechanical appliances. When the whole is finished, or at any time when the architect is away, the whole might seem to an ignorant observer solely the result of the labours of the workmen; so we can only see the results of the operations of the organic force in the material products, originating under physical laws. But when we have ascertained the extent of the domains of these physical laws, we find that they do not reach far enough to account for all. In vegetable life, absorption, evaporation, diffusion of juices, &c., are physical phenomena; assimilation, respiration, and the like, purely chemical; but no physical, no chemical law throws any light upon the process of reproduction, upon the regeneration, distribution, and subdivision of the organic force, upon which the maintenance of the living creation especially depends, since the physical forces are unceasingly striving to destroy it. Vital action must be regarded, therefore, as something superadded to chemical or other physical action.

In vital phenomena themselves, the same subdivision holds as in the forms. In animals as a whole, we have a striking increase of complexity, by the addition of the animal or affective life to the simple organic or vegetable life. In vegetables, the existence is characterized by phenomena of nutrition and reproduction alone. In this there is a relation of servitude to the animal kingdom, the latter being wholly dependent on plants for food, since these are exclusively capable of assimilating inorganic substances, while animals require these elements to be already combined into proximate principles, or organic substances. In animals, nutrition and reproduction constitute merely the basis for phenomena of sense and will. It is obviously unnecessary to pursue this relation any further.

The relation of Botany to the other natural sciences may be now regarded as sufficiently ascertained in reference to its objects and methods taken as a whole. But it is necessary for the proper illustration of the relations of this science to other branches of knowledge, to enter more minutely than has yet been done, into the characteristics of the science itself. And I may premise that the explanations to which we are now about to proceed, may be taken generally as equally applicable to both branches of biological science, Botany and Zoology.

In the abstract part of Botany we have to lay down three divisions, viz.:—

1. Morphology (or anatomy), treating of the generalizations, laws, or principles relating to the form or organization of plants.

2. Physiology, treating of the generalizations, laws, or principles relating to the acts, or vital processes of plants.

3. Taxonomy, treating of the principles of classification of plants.

The concrete part of the science consists of the natural history of plants, in which we study the entire set of phenomena presented by individual plants or groups of plants, or even parts of plants, with a view to practical applications.

Abstract Botany, phytology proper, or, as the Germans call it, Scientific Botany, forms the basis upon which the concrete study, or natural history of plants must rest; and this latter will be rational and fruitful in application, in proportion to the guiding lights furnished by abstract science. But it does not follow from this, that it is indispensable for every prosecutor of natural history to verify or repeat the propositions of the abstract science; in fact the enunciation and demonstration of them, which form the great business of the philosophical botanist, would scarcely come within the sphere of possibility for the generality of mankind, busied with other matters. At the same time, it is an almost indispensable condition of success to those who prosecute natural history in a concrete form, that they should study and adopt the principles which have been ascertained in the abstract part of the science, since otherwise, only chance, or a superhuman amount of labour, can ensure their disentangling the essentials, from the mass of complicated phenomena which present themselves in every observation upon living nature.

Morphology, or the philosophical anatomy of plants, is the branch of science which is devoted to the investigation of the principles which underlie all the multitudinous conditions of form presented by the organized beings of this kingdom. It proceeds by two paths—an analytical and a synthetical—by the analysis or dissection of full-grown plants and their structures (including their teratological or abnormal conditions), and by observation of the gradual development of these from the embryonal condition. By the pursuit of these paths we arrive at a double series of the forms or parts: one half resting on the different orders of characters in the same species, the other on the different characters of the same order in different species. In arranging the parts in the first series, we advance progressively from the organic elements to the tissues, from these to the organs, and thence to the entire organism; in arranging them in the second series, we trace the progressive complexity of the elements, tissues, organs, and organisms, in the different ranks of beings, or in the different stages of development of the same being.

In the first process—simple anatomy,—we perform the first operation for the investigation of laws, the separation of the

particular parts; in the second, in comparative anatomy, teratology, and embryogeny, we are able to make use of analogical reasoning, or tentative induction, in two distinct ways, whereby the agreement of results gives a degree of certainty to our generalizations, which the nature of the objects would prevent our acquiring by any other means.

The same characteristics apply to the modes of investigation in physiology (including pathology, or the study of abnormal deviations from vital laws), which is pursued in a precisely similar manner, but is directed, not to the ascertainment of the laws of development of form, but the laws of vitality, on which depend the manifestations of activity in those forms of organization.

In each department of the science, morphology and physiology, we are led to the recognition of a series, which must serve as the basis of a natural classification of the objects of the study. The inductions of these two branches lay the foundation of the third, namely, taxonomy; and the classification established upon these grounds has a pre-eminent claim to the title of a natural classification, since it is found that the conclusions derived from morphology and physiology coincide in pointing out the rank to be assigned to any organic beings or group of such beings. The form corresponds to the function, in the degree of complexity of the laws upon which each depends.

Taxonomy therefore rests upon principles obtained by induction from morphology and physiology, as these rest each upon the basis of comparative anatomy, teratology, and embryology, and thus a well-established classification of organic beings enables us to study any one or any group of them in its proper order as regards complication of organization, and allows of our placing any kind previously unknown in its proper situation; while the situation which the object or group of objects occupies in the classification affords us at once a general idea of its organization, its mode of life, and with what other objects it is to be compared.

In Botany, the facts of physiology are very general, and in regard to the comparison of different plants, would seem scarcely to aid us in the establishment of a classification, beyond the constitution of the great groups of plants; but as applied in the co-ordination of the different kinds of organs in the same plants, they form a most important element in the institution of groups, founded on the difference of form of these organs in different plants. In other words, the diversity of physiological phenomena in vegetables is comparatively slight, but the diversity of forms of homologous organs is very great; and the rank which the diversified forms shall hold as charac-

ters, in a natural classification, depends upon the physiological value of the organs in which they occur.

It is upon organography that the greater part of the details of classification depend; accurate descriptions of the organs whose homologies are ascertained by morphological and physiological inductions, constituting the materials upon which all the generalizations of taxonomy are finally based. By organography we obtain accurate descriptions of the phenomena of form, that is to say, representations, in fixed and unequivocal language, of the appearances of the objects with which the science deals; and when these are studied in their connection in individual organisms, we obtain such descriptions of living beings as enable us to compare them scientifically one with another. These comparisons lead to the discrimination of resemblances and differences. Under the guidance of ascertained laws of physiology and morphology, we are enabled to separate in these the essential from the inessential; then, by abstraction of the essential resemblances, and dropping out of consideration the inessential differences, we obtain the notion of a *type*. This notion of a type, abstracted from the actual individual representations of the species, forms the unit of all natural history classifications, and the groups into which the species are subsequently successively collected are all founded upon a similar principle of abstraction, under this condition—that the essentiality of the resemblances becomes progressively limited to characters which are more general in a morphological or physiological point of view.

As the taxonomy, or the classification of plants, is that department of Botany which gives it a special utility as a means of mental training, as it is on this ground, above all, that it founds a claim to form a part of general education, it may be permitted me to enter into some technical details here, to illustrate and enforce the propositions just laid down. In the first place the Terminology of Botany demands attention. It is a fundamental condition of the existence of organography, that the botanist should possess a rigidly defined, technical language, a store of descriptive terms, sufficiently copious to denote every part and every quality of the parts of plants by a distinct name, fixed and unalterable in the sense in which it is employed. The technical language of Botany, as elaborated by Linnæus and his school, has long been the admiration of logical and philosophical writers, and has indeed been carried to great perfection. Every word has its definition, and can convey but one notion to those who have once mastered the language. The technicalities, therefore, of botanical language, which are vulgarly regarded as imperfections, and as repulsive to the inquirer, are, in reality, the very

marks of its completeness, and, far from offering a reason for withholding the science from ordinary education, constitute its great recommendation, as a method of training, in accuracy of expression, and habits of describing definitely and unequivocally the observations made by the use of the senses. The acquisition of the terms applied to the different parts of plants exercises the memory, while the mastery of the use of the adjectives of terminology, cultivates in a most beneficial manner a habit of accuracy and perspicuity in the use of language. What is called the Nomenclature of Botany refers to the names given to the abstract notions of the kinds of beings dealt with in classification,—to the species, genera, families, and so on. These refer not merely to the possession of particular attributes, but carry with them the idea of those attributes being distinctive of a *kind* of things. That is, they carry with them not only their definition founded upon qualities, but the idea, superadded to their definition, that these qualities are characteristic of an abstraction. On this ground it has been assumed that they differ in their logical value from the names used in terminology, but there does not appear to be sufficient evidence of this. The names of plants or animals represent in classification those used in organography to denote organs or parts, homologous organs standing in the same logical relation as the individuals of a species.

The principles of nomenclature in Botany and Zoology, since the time of Linnæus, have proceeded essentially upon abstract grounds as regards species, the names not necessarily conveying in themselves any notion but that of *kind*. The nomenclature of chemistry differs greatly in this respect, since the names of the kinds or species generally represent their composition. The names of plants or animals are analogous to the proper names of men, used in civilized nations, to economise words and assist the memory. The different kinds have not independent names, but are designated as members of groups of kinds, distinguished from each other by an adjective term, either indicating a distinctive quality or not, but in any case only necessarily connoting a certain abstract definition of the kind. This abstract definition is not arbitrary, derived from a given type, but constructed by the collection of the most general characters from all those individuals which we conceive to agree in kind. With regard to the organic species, we have certain other resorts, besides direct characters, by which we are enabled to judge as to the agreement in kind, as for example, in the physiological phenomena of reproduction. The notion of a type which comes in here is not used in the sense of a typical individual, but as an abstract standard of reference.*

* This natural-history signification of a *type* seems to correspond with

Species are combined into groups according to the principle of agreement; but these groups, called genera, have not the same biological isolation, at all events in plants, as the collections of individuals constituting a species. They are constituted, however, practically by the same method,—by bringing together those species which agree with each other more than they do with any other species, in the greatest number of the most important characteristics. These groups, in biological language as in common life, are the first which receive substantive names, and the species which they include are distinguished by adjectives appended; thus the botanical name *rosa*, like the common word rose, indicates a genus, including many species, which are distinguished by such appended terms as *canina*, the dog-rose, *centifolia*, the hundred-leaved rose, &c. The mental types of genera are more abstract than those of species, and they become less and less definite as our groups rise in the scale of generality, presenting more and more clearly the universal character of such types, that they are embodiments of a certain definite character which we admit to be associated with others unknown or undefined.

The genera are gathered into groups called orders, or families, founded upon similar considerations. In this way we bring the vast mass of existing species into a smaller and more manageable number of collections, represented by abstractions, in which are contained all their essential characters of resemblance or agreement. There, however, we see the groups composed of smaller groups, which have a collateral agreement or equality of taxonomic characters among themselves; but we find these groups coming into a new relation,—a relation of gradation or serial progression. This is the case even with the orders as included in the classes, and still more when we examine the plan of the classes or grand divisions of the vegetable kingdom.

Taking as a guide the same principles which lead us in the estimation of the value of differences and agreement in the characters of species, we find that the types of the orders are susceptible of co-ordination in a series which shall represent the degree of complexity of the phenomena in which they exhibit the characteristics of vegetable life. Vegetation, or organic growth, and reproduction, are the two principal phenomena of vegetable life, growth being the lowest attribute, least raised above inorganic accretion,—reproduction, the higher, related to, and indeed identical in its characters with, the reproduction of animals. The gradual specialization of the vegetable structures,

the notion of a type, or ideal image, as used in the fine arts, formed by by combining all the characteristic perfections and omitting all the inessential or accidental imperfections of a *kind*.

their distribution into distinct organs, the gradual elimination of the reproductive organs from the vegetative, until they become quite organically independent—these give the order in which the series of vegetable families must stand; this co-ordination being not merely the only one which can be rationally derived from morphology and physiology, in the view of exhibiting the natural affinities of plants, but becoming, like all natural classifications, an instrument of discovery in the intermediate particulars, by analogical reasoning.*

The following table will illustrate these points. In it are laid down the principal classes into which the vegetable kingdom is divided, according to the laws of classification here enforced.

VEGETABLE KINGDOM.

THALLOPHYTA.
- FUNGALES.
- LICHENALES.
- ALGALES.

CORMOPHYTA.

SPOROCARPIA.

AXOGAMIA.
- HEPATICALES.
- MUSCALES.

THALLOGAMIA.
- FILICALES.
- EQUISETALES.

SPOROGAMIA.
- LYCOPODIALES.
- MARSILEALES.

SPERMOCARPIA.

GYMNOSPERMIA.

ANGIOSPERMIA.
- MONOCOTYLEDONES.
- DICOTYLEDONES.

The large groups succeeding each other in this table, exhibit a progression of morphological and physiological complexity, while collateral relations of the same nature exist in proportionate complexity in the particular groups.

The length to which I have dwelt upon this subject of classification may be justified by the following quotation from an eminent writer of the present day.† "Although the scientific arrangements of organic nature afford as yet the only complete example of the true principles of rational classification, whether as to the formation of groups or series, these principles are applicable to all cases in which mankind are called upon to bring the

* Or the method of concomitant variations.

† John S. Mill, Logic, ed. 2, ii. p. 334.

various parts of any extensive subject into mental co-ordination. They are as much to the point when objects are to be classed for purpose of art or business, as for those of science. The proper arrangement, for example, of a code of laws depends upon the same scientific conditions as the classifications in natural history; nor could there be a better preparatory discipline for that important function, than a study of the principles of a natural arrangement, not only in the abstract, but in their actual application to the class of phenomena for which they were first elaborated, and which are still the best school for learning their use."

It remains now to direct attention briefly to the relations of botanical science to various applied and abstract sciences, which are partly or wholly dependent upon it.

In the first place, it must be evident to every one that the general physiology of plants (which pre-supposes a knowledge of the physical and chemical laws influencing them), together with the concrete natural history of the species dealt with, must form the only secure basis of scientific agriculture; that it has not been fully recognized as such hitherto, depends upon its inevitable imperfections, which, however, will be the sooner removed in proportion as agriculturists devote themselves to the study of physiological laws.

Secondly, Botany finds a place in the two cosmological sciences, studying the past and present conditions of the globe, —Geology and Geography.

The perishable nature of vegetable structures, does, indeed, render fossil remains of plants less valuable as objects for palæontological reasonings, than the better-preserved hard parts of animals, especially as the latter afford safer grounds for estimating how much has been lost, how much preserved, of ancient forms of organization. But botanical reasonings form an essential link in geological inductions, although it is requisite to be very careful in applying the analogical method, derived from classification, to the history of the development of the organic creation.

In geography, that is, physical geography, the concrete natural history of plants, or groups of plants, becomes a portion of the concrete natural history of the globe; the physiological laws are involved with physical laws of climate, soil, &c., in the explanations of possible distributions, either in an abstract point of view or for the purpose of practical application; while the systematic classifications and the natural history of particular species become the only guide by which we can attempt to trace back the existing conditions of distribution towards their origin, and thus perform the share due from botany; in the historical

connection of physical geography with geology, of which it is properly only the statical part.

In conclusion, I have one remark to make regarding the discourse I have just addressed to you. It will be observed, that the subject which I was called upon to expound, was the relation of botanical science to the other branches of knowledge, and not the science of Botany itself, the special facts and laws of which, consequently, and especially in addressing an audience gathered together for educational purposes, have been kept back, beyond what was absolutely necessary to its proper characterization; and I have dwelt upon the study as a means of mental discipline and on its practical application, rather than as a branch of science, pursuing knowledge for its own sake. Let it not be supposed that I do not prize it for its last attribute, for inc l I regard this as the highest and best; and I might express y• own feelings in the well-known words of the wise king: "It is the glory of God to conceal a thing, but the glory of a king to search it out."*

If any ask still, to what end? I would quote to him the assurance of the great Restorer of Science,—"Only let mankind regain their rights over nature, assigned to them by the gift of God; that power obtained, its exercise will be governed by right reason and true religion."†

* Proverbs, xxv. 2. † Bacon, Novum Organum, book 1, ch. 129.

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MODERN DISCOVERIES BY THE MICROSCOPE.

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SELDOM has it been my privilege to witness a scene calculated more impressively to show the importance attached in these days to the efficient education of youth than that with which I am surrounded on the present occasion; and whether I cast my eyes around these spacious halls, fitted up as they are with every appliance whereby the truths of philosophy can be most conveniently inculcated, or upon the numerous and important audience that I have the pleasure of addressing, animated as they are with one desire—to aid in the great cause of educational advancement,—it is impossible not to perceive how earnestly they have set about their pleasurable task; it is impossible not to feel that when, in the course of a short time, the means thus placed at the disposal of our schools are distributed throughout our land, results of immeasurable importance may fairly be anticipated.

A new and striking feature in the education of the present day is the practical character of the instruction afforded in our schools, by substituting personal observation in the place of dogmatical teaching, thus affording a broad and solid foundation whereon to build the mental fabric, instead of the flimsy substratum too generally supplied. It is easy to teach any charity child to sing about—

> "The spacious firmament on high,
> And all the blue ethereal sky,"

without exciting any very distinct or definite ideas relative to the awful truths revealed by astronomical science; but it is the use of the telescope alone that can adequately impress upon the mind the grand realities of the celestial spheres. It is easy for any one to expatiate generally concerning the extent of the animal creation, and the limitless beneficence of Providence, but it is the microscopist only who, reversing the Galileæn tube,

explores for himself the deep abysses of a drop of water, and finds therein a world invisible to the unassisted sense, feelingly can appreciate the works of the Almighty.

The inhabitants of a certain district in Sweden, possessing but a scanty stock of corn, had long been in the habit of mixing with their meal a portion of the earth of the country, to supply the deficiency; and this fine white earth, while it increased the bulk, and improved the appearance of their coarse black bread, was found also to be nutritious.

Not many years ago this became a subject of interest; generation after generation blessed the still un-failing supply of mountain meal, but to the learned it was a mystery, for it had long been an acknowledged fact that animal life cannot be sustained by inorganic matter. Many microscopes were speedily directed to the inquiry, and on examination, to the astonishment of an admiring world, this earth was found to be entirely composed of the shells of microscopic creatures, shells, as perfect in their construction as they are varied in their beauty.

Ages ago, water had covered that district of Sweden, and in it had existed myriads of forms, invisible to the naked eye, consisting but of a thin, transparent shell, inclosing a soft, greenish substance, and when this internal living portion decayed, the shell sank to the bottom of the water; and gradually, in long lapse of time, accumulating, what had been water became at length solid land.

Such a discovery as this was eminently calculated to attract the attention of the curious; and subsequent investigations were not long in proving that whole tracts of country—nay, solid rocks—are altogether formed of similar materials. In Peru, in the north of Africa, in various parts of Europe, in our own islands, in the Arctic Regions, the remains of these microscopic infusoria have been found; and the polishing slate of Bohemia, and the Tripoli earth, are used by multitudes who little dream of the origin of the useful substances which they daily employ.

But if many and remote are the regions where these remains are to be found, still more various are the shapes that they wear—mimic crowns, tiny crosses are amongst their graceful forms, and by their variety of figure may be determined the land from whence they come. A coin shows by the impress upon it the name and date of the sovereign in whose reign it was issued—so do these "medals of creation" bear testimony to the eternal power and sovereignty of the Great Ruler of the world.

Nearly 6,000 years passed away before the invention of the microscope; poetry had sought to portray the "flammantia mœnia mundi;" it remained for the microscope to bring them before our view.

But why rest satisfied with a glance at these inanimate remains of the lowest forms of being? Kindred living species may still be found—the sea, the river, the tranquil lake, the roaring torrent, the briny marsh—each has its appropriate inhabitants. But we need not wander so far from home to find objects of curiosity and of wonder. Let us cast our net into the stagnant pool, or roadside ditch, and there, in multitudes, will these creatures be found. Or should we think that this is too much exertion and trouble, let us skim our household cisterns, and even there we shall find objects of amusement and instruction for many a long and perhaps otherwise weary evening.

Interested we may, indeed, be in this widely-spread race of beings, whose countless myriads are the cause of constant though silent and gradual change over the whole surface of the globe.

Let us first examine some of those most similar in construction to the extinct species which have been engaging our attention. The Bacillariæ here appear before us. These tubes placed side by side, and resembling in arrangement the well-known instrument called a pandean-pipe, are of the same texture as the shells which compose the Bergmehl, and are filled with the same soft, granular substance which they once inclosed; here are others, still displaying tubes, but these are laid regularly side by side, like the straws threaded together, which form so convenient a support to the delicacies of our Yorkshire dairies. Others assume a fan-like shape, and with a practised eye and steady gaze we may discern the leaf of some aquatic plant, studded with still more minute fans, each on its slender footstalk; and when we consider that every ray of each of the fans which compose this numerous assemblage is a perfect shell, inclosing living substance, we shall indeed have cause to wonder and to admire.

Amongst these various graceful objects, we cannot pass over those whose grouping produces forms as beautiful as they are regular—stars and crosses as perfect as those which decorate the breasts of the proudest and noblest in our land. Turning from these we may pass to others which, elegant in their whorled shape, and elaborate in sculpture, may bear comparison with the most valued shells in our cabinets.

Dipping our net into some way-side pool, and placing a drop of the water under the glasses of our microscope, we will examine the objects as they pass beneath our view.

And first we discern a flask-shaped creature, moving rapidly in the water; a fringe of hairs at the end of the flask appears whirling round and round, and by the aid of this living paddle-wheel the creature shoots rapidly along in its course through

the mazy dance of other animalcules, who, unimpeded by the general crowd, perform their evolutions in the tiny sea.

But not only is this circlet of hairs a means of locomotion, it is also an instrument for procuring food. Impelled by its motion, the water enters the interior of the enchelis, carrying with it the particles that supply it with nourishment.

Increasing the power of the microscope, we are enabled to distinguish more clearly the forms of some objects which before had appeared to be mere specks; swarms of monads, displaying somewhat of a tadpole appearance—minute creatures, each seemingly a simple bag, with a tail-like appendage, but to this appendage important offices have been assigned; for we are told that, like the hair-circlet of the enchelis, it is at once an organ of motion and an instrument whereby food is obtained.

But Ehrenberg, who has been a most patient and unwearied investigator of these infusoria, has discovered in them wonders which almost exceed our powers of belief; for, leaving in the background these more simple contrivances, he has assigned to them a much more elaborate structure, and hesitates not to declare that they possess stomachs, many in number, connected by a wide canal, branching off in all directions; nay, more than this, that they possess a heart, with a system of blood-vessels, and an eye. Sober reflection, however, and more recent investigation, have assured us that these do not exist. Within the simple bag which forms the body of the monad, may be perceived granules of a greenish colour, and if we mix a little carmine powder with the drop of water in which they float, the coloured fluid received into the creature's mouth, and passing thence into the granules, tints them with a crimson hue, which renders them more easily perceptible to the eye; but the most rigid and oft-repeated examinations have not enabled me and many other studious observers to detect the tubes that are said to connect them.

Adopting Ehrenberg's view of the subject, which he has given to the world carefully registered, and amply illustrated by numerous and beautiful drawings, it would be difficult to imagine how these infusoria dispose of their prey; for it is by no means an unusual occurrence for one of them to swallow a neighbour almost as large as itself, and we can scarcely suppose that this could be comfortably received into one of the many stomachs which, according to the great Prussian naturalist, sometimes amount to 200 in number, or how it could be conveyed through the various branching tubes which are said to connect them; or how a heart and system of blood-vessels can be allotted to creatures whose strange mode of reproduction would render them superfluous and useless; neither can the powers of vision be needed

by creatures such as these, denied as it is to others so much higher in the scale of existence.

Much attention has latterly been turned to this subject, and careful investigations have elicited the truth. The internal globules, supposed by Ehrenberg to be stomachs, at the touch of the magic wand of a sister science, have revealed their real nature; tested by iodine, they have shown themselves to be starch granules; and these infusoria, so long claimed as part of the animal creation, are now given up to the botanist, as belonging to the vegetable world.

We will examine a few more of these strange beings.

Looking with the ordinary powers of the microscope into a drop of water, we perceive minute globes, rolling round and round, having within them smaller globules, revolving, like satellites, not around, but within their parent planet. Let us pause awhile to consider their history.

In an earlier stage of their growth, the imprisoned globules were attached to the internal surface of their parent sphere. There they were at first produced, and to it they remained attached till they were perfected in form, and able to enjoy a more active existence; then, no longer stationary, they were able to revolve freely in the globe that still contained them. Even now we see within these globules others, still more minute in size, already commencing their existence. After a time, the parent globe will burst, and they, her progeny, float freely away in the water. But how is the course of the volvox performed? By means of those hairs with which its surface is covered; these rapidly vibrating, give the revolving motion so visible in its course. But our observation of the volvox must not yet cease.

Increasing again the power of the microscope, we perceive that the exterior of the globe which before had a reticulated appearance, and was studded with small spots, now presents to our eyes fresh cause for admiration, each speck is a monad furnished with a proboscis, and two of those hair-like appendages, which were described as forming the moving organs of the volvox, all connected by the transparent membranous sphere and forming one large community.

Another common and still more beautiful form is that of the Vorticella. Fixed to the stalk or leaf of some minute water plant, we may see a group of long slender stems, each bearing at its top a bell-shaped body, in form resembling a wine-glass, and around the rim of each we perceive numerous tiny hairs, resembling those which circle the mouth of the enchelis, and, like them, rapidly vibrating and producing a strong current, thus ensuring a supply of food to the stationary vorticella. Suddenly we may perceive one of these disturbed in its repast; curling its stem

like a spiral wire, it sinks down towards the leaf on which it is fixed and thus avoids the danger; that danger past, it unfolds its coiled stem, and again resumes the business of its existence. Not far from the group of vorticellæ, we may perceive a small jelly-like mass, shapeless and motionless; suddenly it moves, and becomes in form a star—again and again it changes, perpetually assuming a new and fantastic shape, and from this singular property it has received the appropriate name of Proteus; greedy as it is of prey, a more convenient power could scarcely have been bestowed upon it, for it enables this strange being easily to accommodate itself to the various forms of the large infusoria that it readily swallows.

In my younger days, I was told that in a certain district in the country was a mill where old people could be ground young again; and heartily did I laugh at so absurd a story, little thinking that a greater number of years, more knowledge and mature reflection, would convince me of the truth of the tale, as regards these infusoria, in whom division is multiplication, and what in any other case would be the cause of inevitable destruction, is to them but the occasion of new and vigorous life.

Looking at one of these, you will perceive a transparent line crossing it; sometimes longitudinally, sometimes transversely, sometimes obliquely, according to the different species, at each extremity of the line an indentation may next be observed, which gradually lengthens till the two halves resembles the two continents of America, connected by a slender isthmus; by the continued efforts of both portions they become finally divided, and each swims off to find for itself a separate maintenance. In twenty-four hours a transparent line appears again across each of these divided beings, and a similar division again takes place. This process in the vorticella is well worthy the attention of the few minutes that we can at present bestow. Borne aloft on its slender stem, the body of the creature gradually increases in width till we perceive that the edge of the bell is beginning to divide at two opposite sides, and these cracks extending, it at length is seen to be rent into two equal halves: one of these closing together resumes the former shape, and the other portion, by the aid of vibrating hairs which now appear at its lower extremity, swims away, till finding a convenient spot on which to fix its abode, it anchors there, and soon rising on a new stem, becomes the first inhabitant of a new land very speedily to be colonized by its descendants. Frequently, both halves of the bell at once quit their original stem, leaving it to wither away, and both become travellers through their watery world. Rapidly as these may seem to multiply, there are others where the powers of reproduction are developed to a still more marvellous extent.

Of these the Gonium Pectorale, is an example; across this compound animal several transparent lines will appear, and these lines becoming more and more defined, what has before been one is now separated into sixteen different bodies, all shortly again to be divided in a similar manner. We have heard of the calculation of the nail in the horse-shoe, and the squares on the chess-board, and beguiled many a sleepless hour by vainly attempting to complete the reckoning; but these are trifles compared with the computation of the descendants of a single monad, which, in one month, would equal the number of the inhabitants of this globe.

A grain of sand appears of little importance; but the shores which say to the ocean, "Thus far shalt thou come, and no farther, and here shall thy proud waves be stayed," are but composed of multitudes of these grains: so these myriads of simple forms oppose a barrier to chaos and to death, and retain within appointed bounds all that may contribute to animal existence. These infusoria form the base of that pyramid of animal life at the apex of which man has proudly stood for 6,000 years, without discerning that foundation to which it owed its strength and its security.

The microscope is a most valuable instrument, both for education and for amusement, and may be an important means of inducing in the young a habit of admiring the works of Nature, a habit calculated to refine and to elevate the mind, and to render it less liable to be dazzled by the glitter and glare of more obtrusive though less real pleasures.

Every walk in the country will not only delight by present agreeable exercise, but by the simple materials casually collected during the stroll, may furnish employment for many a succeeding day,—every flower, every insect, will furnish a store of objects for our investigation.

Costly apparatus is not needed, nor is great advance in science necessary to the person who uses it. The patient and careful investigations of the simple but intelligent observers of nature, have frequently been the means of bringing to light many valuable but hidden facts, and the most important observations have often been made by the most simple means. Many of the discoveries of Ehrenberg himself, were made by means of a pocket instrument.

While the collection of specimens may give an interest to every stroll in the fields, their preparation and preservation will afford varied and pleasant work for many a winter's evening: it will yield amusement during solitary hours, or engage a whole family in cheerful and animated employment, even childish hands

may be pleasantly occupied, and their owners delighted to be thought able to join in the general pursuit.

Thus may the microscope afford quiet and never-ending amusement, and not amusement only, but the most important of all instruction; for it affords us visible proof that God not only clothes the lilies of the field, and the grass which is cast into the oven, but that He perpetually cares for these myriads of creatures, so small that they are invisible to the unaided sight; and how then shall we, so much more highly favoured, ever fail to rely upon His fatherly providence, and His unwearying care!

ON THE INFLUENCE OF EXAMINATION AS AN INSTRUMENT OF EDUCATION.

By the Rev. Dr. Booth, F.R.S.

The Council of the Society of Arts have felt that the value of the Educational Exhibition here collected might be greatly enhanced, were advantage to be taken of the occasion to discuss from this place, before those who take an interest in the subject of education, those questions on which there may exist some diversity of opinion, or about which the public may require information. I believe that the opening of this exhibition will mark an era in the history of the progress of national education in this country. It will clearly show how great is the interest which is taken in this peaceful question in these very exciting times. It will show further how great an amount of mechanical skill, of correct appreciation of the true methods of imparting knowledge to the young, and of commercial enterprise, is engaged in this country in the business of providing educational appliances for schools. I believe that, were it required, a space equivalent to three or even four times the room occupied in this building might be filled with educational apparatus; and this points to another great advantage which will result from this exhibition: it will clearly prove to those who have a potential voice in directing the progress of national education, that the cause of its shortcomings and imperfections is not to be sought in any deficiency in an ample supply of educational apparatus of the very best and cheapest kind which the cost of labour and materials will allow. I have no doubt whatever that were it possible to establish 10,000 schools to-morrow on the very best and most approved principles, each furnished with a highly qualified and well-trained teacher, and with a full supply of pupils, they could be provided in the course of a few weeks with all the most improved appliances of instruction, and at a very low price.

This exhibition will therefore serve one good purpose: it will limit our inquiries when we proceed to investigate the causes of the imperfect development of the education of this country. It will be satisfactory to be able to show that it is not due to any deficiency or shortcoming in the supply of the material appliances of instruction.

Before we pass away from this part of the subject, I may be permitted to express a hope that this most valuable and useful collection shall not be forced to share the doom of its great predecessor, and be resolved again into its constituent elements. A collection such as this does not develop its utility when it is made an excuse for sight-seeing or for dilettanti examination. Its proper function would be to serve as a medium of reference for those who are engaged in the practical work of instruction. For such a one, what a saving of time and money would it be to have a place within his reach, in which he might have brought together for his inspection and choice a varied selection of the most approved and most modern apparatus! But this would be not the only nor the greatest advantage of such a permanent collection. Obsolete modes of teaching, and long-condemned appliances of instruction, hold their ground in many schools, simply because there is no way of bringing under the notice of schoolmasters the great improvements which are made, from day to day, in the material helps of instruction. I should, therefore, deeply regret to see it broken up a few weeks hence; and I trust, if nowhere else, it will find a refuge, and nowhere more appropriately, than in that splendid palace of the people which witnessed its inauguration.

But having said thus much, I must add, that educational apparatus, after all, are but the dry bones of education. Some people seem to imagine that a large supply of apparatus is the great desideratum of the present day. This I believe to be a pernicious delusion. There is scarcely a school of any pretension in the kingdom, which has not its pair of globes, celestial and terrestrial, its barometer in many, an electrical apparatus, and sometimes even a chemical laboratory may be found; but does not every body know that such educational apparatus are kept for show, as part of the advertising economy of the school? How rarely is an attempt even made to give real instruction in the sciences to which those instruments belong! No! progress must be sought for in a very different direction. A great error will have been committed, should the public be led to anticipate a real advance in the true work of education by the accumulation or the multiplication of the material appliances of instruction. Were education in a flourishing state, the common commercial principle of supply and demand, in this country of mechanics and

commerce, would always secure an ample provision of any apparatus that might be required.

Besides it is a mistake to imagine that a lecturer must be provided with a complete set of apparatus to teach. A man who knows his subject will often extemporise his apparatus. It is told of Dr. Wollaston, the celebrated natural philosopher and chemist, that when a distinguished foreigner solicited permission to inspect the laboratories in which those splendid discoveries which have immortalized the name of Wollaston were made, the Doctor took him into a little study, and pointing to a tea-tray with a few glasses and a blow-pipe on it, said, "There is all the laboratory I have." The old proverb is perhaps not far from the truth, which says, "A good workman does not complain of his tools." It is right to call attention to this phase of the question, because there seems to be just now a great tendency in influential quarters to labour in this direction, to make the public believe that by providing an ample supply of varied, cheap, and ingenious apparatus, the cause of education is as effectually promoted as can reasonably be expected. I entirely dissent from any such views. There are only two ways by which a real advancement can be secured,—to provide an adequate supply of well-trained teachers, and to give to the pupils sufficient motives for exertion. These are the two great conditions in compliance with which only can real progress in national education be secured. The teacher is the soul of the school. Provide an ardent, energetic, and well-disciplined teacher, a man who has his heart in his work and knows it, and you may depend upon it the want of apparatus will not long be felt. But however important may the condition be of a supply of well-trained, well-instructed teachers, it is of far less moment than a provision which would afford an adequate stimulus to the minds of the pupils themselves. If this could be secured, I believe all other conditions would be of minor importance. Now this can only be done by holding out to the pupil a hope, if not a certainty, that he shall be rewarded for his labours—that his attainments shall be tested and certified. It is no better than a solemn trifling with the question, to say that men should be taught to labour from higher inducements than a hope of advancement or reward. Granting the abstract truth of the principle, we must, notwithstanding, allow that the hope of reward and the desire of praise is universally implanted in the human breast. We must deal with man as we find him. I propose to myself to prove that a system of general examination would be the most powerful instrument we could employ to promote a truly national education, and that it would enable us entirely to elude the religious difficulty which on all sides besets and hampers us—a difficulty

which bears high testimony to the conscientious spirit of the age, to the truthfulness and the reality of our religious convictions. There is nothing new however in the principle, whatever there may be in its applications. It is the principle on which our universities, without any external supervision or control, continue to provide an admirable training for the minds of those committed to their charge. Experience has forced it on our older universities: it is exclusively the system of the University of London. It was no part of the original university system. The professional element was the original feature. The tutorial was afterwards introduced, and has practically superseded the former.

But it is not in the universities alone that examination is used as an instrument to promote education. In the learned professions, as they are called, with the exception of the bar (which is, indeed, no longer an exception, and which might continue an exception without much practical injury, for practice at the bar is nothing less than an arduous and continuous public examination), in the royal navy, and lately in the army and in our commercial marine, and still more recently in the East India Company, examination has been used as the great instrument for promoting and testing proficiency in the acquisition of knowledge.

But by far the most important move in this direction is the proposal on the part of the Government, which has been formally recommended in the speech from the throne at the commencement of the present session, to throw open to public competition the appointments which are now the private patronage of the ministers of the crown. Although this measure has been advocated by its great promoters, Sir Charles Trevelyan and Sir Stafford Northcote, solely on the ground of its tendency to improve the education, and thus to increase the efficiency of those employed in the public offices, yet I will boldly assert that no measure, however popular, could be devised, no grant of money, however large, could be voted, which would at all to the same extent, or in any like degree, promote the education of every class in the community. This will doubtless appear to some an exaggerated statement, especially to those who may not have traced with care the collateral advantages, and the far-pervading influences of such a system. That it is not so, I hope to be able conclusively to show you before I have done.

Such a measure as this, voluntarily proposed by a government, not with a view to escape from external pressure, nor to conciliate popular support, bears unimpeachable testimony to the disinterested spirit of public men at the present day. It is still more remarkable, as showing the real apathy of the public as to the progress of this question of education, that this self-denying

ordinance of the government, this proposal to denude itself of patronage for the benefit of the public, has been received with marked coldness by that very public for whose benefit it was proposed. Lord Granville and the Duke of Argyle have ably defended the measure against the attacks of professing friends of education, while a portion of the press, to which the *Times* is an honourable exception, which boasts itself the friend of progress and the advocate of reform, argues against it on principles which, if admitted, would prove that ignorance is the very best qualification a man can have for the efficient discharge of public duties.

Some six or seven years ago, I wrote a pamphlet,* and published it under the title "Examination the Province of the State," in which I gave the outline of a system very similar in principle to that which is now recommended to the mechanics' institutions of the country, by the Council of the Society of Arts. The plan was somewhat as follows:—Let the Government establish a rule, or let the legislature, if necessary, enact a law that no person after the year —— shall be admitted to any employment under the crown, or be eligible to discharge the duties of any public official appointment, who shall not either have taken a degree at some university of the United Kingdom, or passed through one of the military colleges, or obtained a certificate from the board of examiners, hereafter referred to. Let such a certificate have the effect to place the holder in the class from which all official appointments must necessarily be filled, but not to give a claim to such appointments as a matter of right. This rule being established, let us further suppose the whole country to be divided into districts or educational circuits, of such extent as the state of education and the amount of population might require, and that a board of examiners were appointed by the crown, who should hold in each circuit an annual examination of candidates in courses of subjects by them previously appointed. At this examination all persons should be permitted to present themselves, no matter where educated. This board should be empowered to issue to successful candidates certificates of three classes—the third-class certificate to be awarded to those who should show that they had a fair average acquaintance with the subjects set down for the ordinary examination, the second class to be conferred only on those whose answering should be of a high order, while the

* "Examination the Province of the State." By the Rev. James Booth, D.C.L., F.R.S., &c., President of the Literary and Philosophical Society of Liverpool, and Chaplain to the Marquis of Lansdowne. London: John Parker.

first-class certificate should be reserved for those who, in addition to the knowledge and answering which would qualify them to obtain the second-class certificate, should undergo a voluntary examination in the higher departments of some course of literature or science (to be selected by themselves under certain obvious restrictions), and who should prove their knowledge to be extensive and accurate. The board of examiners should publish in a cheap form, or sanction the publication of an educational gazette, which would contain accounts of their proceedings, of the examinations that had recently been held, and which should give the names of the successful candidates, the class of certificate adjudged, their residences, the schools at which they had been educated, the number of those who presented themselves for examination, and the number rejected. It should be, moreover, an established rule that no examiner inspect or visit officially any school. Their duties should be strictly limited to examine such candidates as should voluntarily present themselves for examination, and to award the proper certificates. A certain sum should be charged for each certificate; to issue them free of charge would be injudicious—men seldom much value that which costs them nothing. These are the bare outlines of a plan that would require very little preliminary organization. No capital to be expended in costly structures, or in architectural decorations. It would interfere in no way with the present schoolmasters. Treating churchman and dissenter alike, it would tend to calm down religious animosity; and while it would carefully provide that the duties of religion should be inculcated by all sects, it would not meddle with the doctrines of any. There would be no grounds for the separation of religious from secular instruction. Both being left in the hands of the people themselves, their union might be secured with the utmost safety. No candidate should, however, be permitted to present himself for examination without producing a certificate from his clergyman or other religious teacher, testifying to his moral character and religious knowledge. It would not interfere with any established functionary, nor supplant any local authority, nor deprive any corporate body of their rights. Self-supporting, it would elevate the education of the middle and lower classes to a degree of which we can scarcely form an adequate conception; and, finally, it seems less open to grave objection than almost any other practicable one which could be devised. It would be difficult to propose, for the promotion of education, any scheme, even of the most meagre kind, which would interfere so little with prejudices, or with voluntary exertion.

Now, what are the obvious advantages which would flow from such a system in active operation? In the first place, the crown

would be able to select its officials from the certified talent and education of the country; this, however, is but to take a very narrow view of the resulting advantages. Were none to present themselves for examination but those who happened to be at the time, or prospectively, candidates for government appointments, the benefits of such a plan would be very partial indeed—in practice the result would be very different. It would be found that nearly the whole of the youth of the commercial and middle classes, and a large proportion of the children of the poor, would after a short time present themselves for examination, and the reason why is obvious enough; for though few would or could form to themselves any well-grounded expectations of obtaining a government appointment, or perhaps even desire such, and though the great majority would propose to themselves a very different future, yet few, I apprehend, would voluntarily erect such a barrier to their own advancement as deliberately to disqualify themselves from accepting a public appointment. It might, too, be well deserving of consideration, if such a plan as this should ever be carried into actual operation, whether municipal corporations and railway companies, over which parliament exercises control, should not be required in their future appointments of persons under a certain age, to accept of none but certificated candidates. With a somewhat similar view the Council of the Society of Arts intend to propose a declaration, to be signed by merchants and mercantile firms of eminence, by manufacturers and other employers of labour and skill, by railway, steam-boat, and other companies, to the effect that the undersigned will be prepared to accept, as trustworthy testimonials, the certificates issued by the board of examiners of the Society of Arts.

But this declaration, however generally accepted and even acted upon, could never exercise the same influence as a recognition of the principle by the State.

Were it once embodied in a system in actual operation, at no very distant time the royal certificate would be looked upon as a necessary pre-requisite for any young man who should seek admission into one of those industrial professions which, at the present time, afford so many openings to industry and talent. The testimony of the board of examiners would be held as conclusive evidence that the candidate had acquired such an amount of general information and technical knowledge as would qualify him to enter on the practical duties of his intended profession. We should in a short time find the youth of the middle, and, to a great extent, of the poorer classes too, with minds well stored, and with intellects developed, taught to rely on their own ener-

gies, and, diverging from this point as from a common centre, bearing with them into their new pursuits that steadiness of application, that force of will, that facility in turning the well-trained faculties of the mind on an untried subject, which previous exercise of the understanding and habits of patient study can alone bestow.

[The lecturer then referred to the report of the Committee of the Society of Arts on industrial instruction, in which the question of examination was discussed at length, and the strength of public opinion in its favour shown.]

Such a plan as this would do more to raise at once and immediately the character of the instruction of the middle and even of the poorer classes, than almost any other practicable scheme that could be devised. It would call for no previous outlay, and would require no tedious preliminary organization. Taking the materials and tools already provided to hand, it would operate upon and by them. It would not impose the necessity of building new schools, or of founding colleges, or establishing professorships, but being applicable to the schools and educational machinery already in existence, would leave education in those hands in which it found it. It would interfere with no vested rights, whether real or supposed. Co-operating with all, antagonistic to none, it would neither provoke the hostility of the bold nor alarm the fears of the timid, and as it respected the rights of conscience and the religious feelings of every class, it would have no tendency to excite sectarian animosity. The Government, freely offering the same advantages to all, presenting the same friendly aspect to all alike, to churchman and to dissenter, acting in friendly co-operation with existing schools and educational institutions, would be welcomed rather as a fellow-labourer than viewed with suspicion as an interloper.

There would thus be no grounds for the separation of religious from secular instruction. Both being left in the hands of the people themselves, their union might be secured with the utmost safety. Thus the duties of education would be divided, and left to those severally best able to discharge them; instruction would remain in the hands of the people, while examination would be the province of the State.

In no respect would the operation of such a plan be more beneficial than in stimulating voluntary exertions, the building of schools, the appointment of masters, the adjustment of salaries, the choice of plans of instruction; while the religious teaching would continue in the hands of the local promoters, it should be the duty of some recognised established authority to pronounce whether the provision made in any locality was ade-

quate or otherwise, the progress of education satisfactory or the opposite.

If the effect of such examinations on the character of school-teaching would be so manifestly beneficial, much more important would be their influences over the pupils themselves. As matters now stand, for the youth not intended for college, the incentives to exertion are as few as they are feeble. There is but little to stimulate him to exertion. He knows that he must remain at school until he is old enough to proceed to business, but he cannot see why he should weary himself with study. Now were he certain that on leaving school he must go before an impartial examiner, be subjected to a searching examination, be compared with boys from other schools, that he would have his attainments and deficiences brought out clearly before his neighbours and friends,—what motives to exertion would not be at once supplied? what habits of industry and perseverance would not be encouraged? Above all, the practice of self-instruction would be strengthened, a habit far more valuable than any amount of school acquirements. The latter will gradually drop out of the mind or be crushed out by the business of life, but the habit will remain, ready to be applied to any subject which may require patient investigation or continued attention. Schools and schoolmasters, lectures and examinations, prizes and certificates, are useful so far as they promote this; it is the necessary adjunct, and, I may say, also the necessary condition of intellectual development.

If, then, the formation of habits of patient study and of persevering application are among the primary objects of a wise education when applied even to the highest, so should they, in an especial manner, be looked upon as such in the education of the poor. On those whose education extends over no inconsiderable portion of their lives, such habits will, from the very nature of things, force themselves imperceptibly into vigour; they will grow with their growth and strengthen with their strength, and this too whether much or little external pains be taken; but with the children of the poor the case is different. They cannot wait for the slow development of good habits; they must be forced into maturity. As the stay of the poor at school must, under the most favourable circumstances, be short, it is of incomparable importance to them to be taught to exercise their faculties, to form habits of self-labour, assiduous perseverance, and voluntary application. In truth, the amount of facts committed to memory at school is of very inferior value indeed, when compared with the habits which may be formed by their acquisition. When a boy, in whom habits of self-instruction and industry are thoroughly

formed, leaves school, they stick to him with all their characteristic adhesiveness. He is qualified by his acquired habits to turn his mind with effect to any subject of study for which he can find time and has the inclination; while another lad we shall suppose of equal natural ability, and with a far more varied stock of facts, is quite helpless. He has been taught everything he knows by others and has learned nothing by himself—when his corks are removed and he is cut adrift, at first he probably endeavours to add to the little stock of knowledge which he had so easily acquired. But not knowing how to set about it, unskilled in the use of his faculties, looking always for help from some one or other, he flounders on, until at last he gives up all hope of learning—he becomes disgusted with reading, and sinks at last into a state of ignorance little removed from what we may suppose it would have been, had he never received an hour's instruction. How often may one hear the labourer saying, "I was teached all these things when I went to school, but somehow I have forgotten them all." To what cause, other than this, was it owing that the old grammar-schools, with all their antiquated absurdities, so often sent out men of energy, learning, and talent; for while the matter learned was often worthless, the habits formed during its acquisition were invaluable. Habits well set, so to speak, would be of more value to a youth leaving school, than if he had been crammed with all the facts contained in all our popular compendiums of useful knowledge. It is, it must be granted, quite true that little can be done without earnest and zealous teachers, carefully and systematically instructed in the duties of their calling. I say systematically instructed, because it would be as hopeless to expect to train efficient schoolmasters without the aid of normal institutions, as it would be to teach the art of healing without hospitals or theatres of anatomy. It is, however, true that the schoolmaster cannot accomplish every thing—the hearty co-operation of the pupil is, at least, as equally essential to success. Another great advantage would result from the adoption of a plan like this,—boys would be induced to remain longer at school, and not to leave it as they now do, when not more than twelve or thirteen years of age, in a half-educated state, without a single valuable habit formed, or any useful acquirement made. Of all the evils which beset the education of the middle and lower classes, this is perhaps the greatest; unless this be amended, other reforms are comparatively valueless. What is the use, for example, of providing new schools, or a better class of teachers, or improved apparatus for those who will not use them? Now, for this admitted and deprecated evil, the plan proposed would supply a thorough, prompt, and universal remedy. Though a

parent might despise education and deny its utility, though he might make little of learning, and look with suspicion and dislike on the public examinations, yet the consideration that the future progress in life of his son might depend on his obtaining the royal certificate, would compel him to leave his son at school that he might qualify himself to secure it.

Influenced by views not very different from those which I have now placed before you, the Council of the Society of Arts appointed a committee of its own members, in the early part of last year, to investigate the subject of industrial instruction, and to report thereon to the council. The committee took the opinions of the most eminent manufacturers in the kingdom, of the principal engineers, of the great employers of labour, of the head-masters of the grammar-schools, of those engaged in the duties of instruction generally, and of the best known friends of education. In reply to their inquiries, which they divided under eight heads, they received a very large amount of the most valuable correspondence, hailing almost without a single exception the advent of reform, or even of change in the present state of things.

The committee embodied a large portion of this correspondence in an appendix which they added to their report* presented to the council a little more than twelve months ago. Among other points referred to, the question of examination was discussed at much length, and the strength of public opinion in its favour shown. More recently, the question has been noticed in the address from the chair at the opening of the last session—it now remains to be seen whether the proposal of the Council of the Society of Arts to appoint a board of examiners, will receive that amount of public sympathy and general support which would justify them, in the eyes of society at large, in proceeding with the development of so important a measure. With regard to the moral character of the candidates, and their state of religious knowledge, it is obvious the examiners could make no direct investigation. This, however, is but little to be regretted, because it is precisely the point on which examination is least efficacious; for however valuable a searching examination may be to test a candidate's critical knowledge and intellectual apprehension of the truths of revelation or of the articles of faith, how far this knowledge may have changed and purified his moral nature, hallowed his affections, or sanctified his heart, it is wholly inoperative as an instrument to discover.

* "A Report on Industrial Instruction, presented to the Council o the Society of Arts by the Committee appointed to Investigate th Subject." London, 1853. Longman and Co.

No candidate should, however, be permitted to present himself for examination without producing a certificate from his clergyman or other religious teacher, testifying to his moral character and religious knowledge.

While I so earnestly contend for the principle of emulation, and its exponent examination, as one of the most powerful instruments that a knowledge of the faculties of the human understanding has placed within our reach, I at the same time just as earnestly deprecate its introduction into religious training. So far as Christianity may be considered a science, emulation and examination will insure a knowledge of it, just as they will of the science of jurisprudence for example. If the Bible is to be used with the same objects, and for the same purposes, as a treatise on some branch or other of science is studied, or as the history of an ancient nation may be read, with a view to develop the powers of the understanding, or to store the mind with curious knowledge, let there be by all means searching examinations; let the principle of emulation be developed; but if the book has been given for far other uses, if it has been set up as the standard of our faith, and a light to our path, our ornament in prosperity and our stay in affliction, to be the mould of our habits and the rule of our conscience, to hallow our thoughts and to elevate our affections, let us not seek to degrade it by dragging it down into the arena of intellectual conflict. Let us not set an answer in geography against another in the gospels, nor weigh a theorem in Euclid against a truth in the epistles. If the great object of religious instruction be the formation of religious character, we should use instruments fitted to produce this result. Let us not take into our hands instruments which, however valuable they may be as enabling us to secure other important objects, are yet unfitted to accomplish this.

But there are those who will say—such a measure as you advocate would lead to very great and important changes in the social and moral aspects of the country. We freely admit the charge. They would lead to such, unquestionably. But change is the condition of the life of every organised being. To cease to change is to cease to live. It is no less so of the life of a nation. Contrast the United States of America with the worn-out empires of the East, which have long since passed away. The restlessness of the ocean does not affect its stability. It is the condition of life for all within its bosom. Changes like those we advocate are but the developments of a healthy growth, and of a progress upwards to a long maturity. Change is life, sameness is death. That unchanging aspect of national institutions which has been sometimes lauded, is almost always to be deprecated, for time has shown that reform does not imply sub-

version, and that long-unchecked decay does not admit of conservative renovation. Moreover, when an institution lives in the heart of a nation, the parasitical support of protective laws checks its development and cramps its growth. We trust, then, in the onward progress of legislation; and that as our people increase in knowledge, they will also grow in wisdom; and that these plied together will be the strength and the stay of a hope of better things to come, and of the stability of the present, and "wisdom and knowledge shall be the stability of our time."

ON MODELS AND DIAGRAMS.

By T. SOPWITH.

MY present object is to speak of MODELS and DIAGRAMS, as applicable to ordinary use in schools.

Of these, models are the more valuable, inasmuch as they represent the solid form of an object, and can be viewed in any direction, whereas a diagram, even in its most pictorial form, only presents one aspect of the object; and if different portions of the same object are required to be shown, they must of necessity be delineated in separate diagrams. The portability and cheapness of diagrams, however, as compared with models, render them, on the whole, better adapted for extensive use in schools; and even the disadvantage of presenting only one face of an object may be turned to some account, and become a means of instruction, inasmuch as all the practical applications of drawing depend on a right appreciation of the laws under which solid forms can be represented on a plane surface.

The present time is more especially suited for some illustration of this subject, inasmuch as an opportunity is now afforded in this exhibition whereby every one may examine a great variety of the best models and diagrams. And precisely in the degree in which such opportunities are afforded, it is important that teachers of every class should endeavour to study their importance, and to adopt them in their several schools.

It is not my intention here to speak at any length on the subject of what may be called the highest class of models, in which machinery, or any other complicated conditions, are exhibited; because such models are only to be found, generally speaking, in the hands of those who are competent to use them, and fully illustrate their several properties. Such models are not attainable in ordinary schools, nor can they ever be largely applied in the general purposes of education. I would, however, observe, that one or two really good models of mechanical construction, of a superior description, cannot fail to be of use, as examples of

the highest class of illustration, and as a standard with which to compare the more elementary forms—and in works of art a few very excellent examples may be obtained at a moderate cost. For general use, however, in schools, models must be, as much as possible, of a simple and inexpensive kind, and it is to such as are within the scope of ordinary schools that I would now more especially advert.

The real use of a model is to carry the mind from the actual observation of a small object presented to the eye, to the comprehension of a larger object not presented to view, and in doing this the mind is necessarily employed in a study of relative dimensions, and of corresponding forms. Excellent models of geometrical forms, as the cube, &c., are to be had at a small cost; but in the smallest village school, unprovided with funds for the purchase of expensive models, much may be done at a very small cost—as for example, the construction of a cube, and other geometrical figures, may be explained by a piece of pasteboard, and the mode of construction is in itself an explanation of geometrical conditions; as for example, that the tetrahedron is bounded by four surfaces, the cube by six, and the pupils may with advantage be exercised in the construction of such figures. The instrument called a *gonigraph* may be easily made by a country carpenter, or even by a skilful lad, and is well represented by the ordinary scales or rules used in France. It affords a ready model of various geometrical figures, and derives its name from Greek words, signifying to draw or describe angles. I am now adverting to the simplest forms of illustration, but which, simple and elementary as they are, we do not find them in the generality of country schools, although much progress has undoubtedly been made in late years in this direction. I do not attempt, in the compass of a single lecture, to notice the various models which are applicable to schools, or to describe separately the mode in which they are to be used; my chief object is *to urge the universal adoption of models and diagrams, as a means of instruction*, and to illustrate by one or two familiar examples the manner in which very cheap and simple, and yet effective models may be brought within the reach of even the village schoolmaster.

In astronomy it is desirable that all scholars should learn something of the motions, and magnitudes, and distances of the heavenly bodies. The most rapid motion which can be readily comprehended by boys is about twenty miles an hour, or one mile in three minutes. It is about double the quickest speed they see in road vehicles, and is a usual rate on railways, but it will be brought still nearer to their comprehension within the walls of the school-room, by a white ball fastened to a string of

about three feet in length, and whirled round at the rate of two revolutions—nearly forty feet in each second. By graduating the length of the string, and timing the revolutions to 120 in each minute, the length of *a mile* may be described by the ball in three minutes; and if this were continued an hour, we should have twenty miles of space passed over by the ball. When once the minds of children are directed to a palpable illustration of this kind, they have obtained, as it were, the seeds of knowledge—they have a foundation on which to rest future researches of a like kind, and without some such *solid, distinct, clear,* and *palpable* exhibition of the *rate of motion,* no definite ideas will be afforded by the most skilful and elaborate study of mere figures unapplied to some such datum as I have here endeavoured to describe. Very few persons have clear conceptions about space and motion. If we ask a child the meaning of a sentence which it has read, we probably find that no solid or distinct ideas of the meaning of the sentence have been formed, and so it is with children of a larger growth—with men, and even with able and accomplished men—propositions involving large conditions of space and motion are read and stated by them as truths, without even attempting to resolve them into tangible considerations. What, for example, is so common as to hear it said of Archimedes, that if he had a fulcrum on which to base his operations, the power of a lever would enable him to move the world, and so it is taken for granted that by an enormous lever, the weight of Archimedes, exerted at the extremity of its enormous arm, would suffice to move the world. In *theory* this is true, but how few have an idea how far it is *from all practical value.* If Archimedes had machinery free from friction, and in perfect equilibrium, so that his whole power could be made available, it would require, at sixteen hours a day, and using his whole power, *more* than *seven millions of years* to move the earth. But then it may be said—what do you call motion—through what vast space would he not have moved it in that immense period, if endued with life amounting, one might almost say, to a fraction of eternity itself? I have assigned a moderate enough space, through which it would be moved, viz., the *one hundred millionth part of an inch.* If we consider, then, that of this $\frac{1}{100000000}$ of an inch, only about $\frac{1}{360000}$ part could be accomplished in the incessant labour of fifty years, we find that it amounts to so inconceivably small a space, so very far beneath the utmost power of the microscope, that instead of confirming the notion of motion, it seems, if it were possible, to add value to the notion of actual permanency. Now, in carrying ideas of space and motion from terrestrial to celestial objects, I may mention a very simple and pleasing illustration. Suppose a

white ball, of ten or twelve inches diameter, placed in the open air on a clear day, when the sun and moon are both visible. The ball may be so placed as to appear immediately under the moon, when viewed through a small aperture properly fixed. It may be so placed also in regard to distance from such aperture, as to appear about the same size of the moon. Now, if the sun's rays fall on this ball, just so much of its surface will be brightly illumined as will correspond with the light portion of the moon, and the teacher will then explain that the rays of the sun are falling on two balls or globes—the one the moon, at a great distance, the other the ball, of ten or twelve inches—and by moving the latter, the increase of apparent diameter as it is brought near, and the decrease of its magnitude when removed further away, may be fully explained. On the following day similar lessons may show the altered position of the moon, and the reason of its altered phase, and illustrations of this kind may serve as a foundation on which to convey information as to the other heavenly bodies. I recommend circles to be painted on the school ceiling, representing the earth by one inch in diameter, the moon one quarter inch at a distance of thirty inches, and an outer circle of nine feet two inches in diameter. to represent the circumference of the sun. When these enormous magnitudes have been in some degree appreciated, the distance of the fixed stars on the same scale, amounting to much more than 10,000 miles, may afford a further and most astounding example of the greatness and glory of the works of the Creator, as exemplified in the scale of the universe.

I now offer as an example of geological models, one which admits of being easily constructed, namely, by cutting sheets of variously coloured paper so as to show the relative position and area of the geological formations of Great Britain. In this manner also, models of local districts may be easily made, by adopting the course of rivers as a base of operations, and then moulding the hills according to a scale of altitudes. Models of school-rooms, in card-board, might be made by active and ingenious scholars; and the great beauty of neatly-made paste-board models is such as to render them peculiarly fitted for exercises at school.

The lectures of the late Richard Dalton were an example of the great utility of models. He possessed a very large collection, illustrating mechanics, hydraulics, hydrostatics, optics, and astronomy. Among them were Attwood's machine for explaining accelerated motion, a printing press, a machine or portable mint for striking medals, a stocking-making machine, a working model of a locomotive engine and of various other steam engines, optical models, telescopes, microscopes, &c. It is much to be

wished that similar collections of models could be found in every large town, and if moderate sums were appropriated by government to be given as premiums for such models, it would develop a large amount of practical merit, and be the means of furnishing an ample supply for schools.

The restorations of extinct animals now in progress at the Crystal Palace, by Mr. Waterhouse Hawkins, bid fair to create a laudable interest in such studies; and I am glad to have an opportunity of showing, by the small models now on the table, the clear and satisfactory manner in which Mr. Hawkins proposes to show, not only the external form, but also the anatomical structure of the bones,—one side of the model being open for this purpose, whilst the other gives a complete view of the exterior.

Great animation is excited in the minds of children by any exercises which involve manipulation. If furnished with pieces of pasteboard, they will soon learn to construct a rough model showing the walls of the school, and so proceed to represent hills by fixing wooden pins at intervals of the requisite height. In like manner they may cut out in paper, or in cardboard, areas representing the comparative magnitude of kingdoms, and thus arrive at some tangible notions of the dimensions of the globe on which we live, and of the planets and stars which adorn the heavens by night. The great value of all such instruction is the right direction of the mind and understanding, so as not only to know the condition of matter, but to feel that all nature pictures forth images of the greatness and glory of God.

Under the term of diagrams, almost every description of drawing may be included, inasmuch as highly-finished pictorial effects are sometimes required to illustrate architectural and geological, as well as historical and other subjects. The numerous and interesting specimens shown in this exhibition render it unnecessary either to describe them or to speak in general terms of their great beauty and value. My object is to draw attention to the means by which they may be more extensively used in ordinary schools, and to this end we must consider more especially—

The principles of construction;
The objects capable of illustration;
The materials to be employed; and
The special advantages they afford in promoting education.

There are certain guiding principles which regulate the correct practice of all arts of design, and a knowledge of these is essential to the teacher.

A diagram is the representation of one or more objects on a plane surface.

If we suppose a cylinder to be the object of which a diagram is to be made, it is evident that if the *end alone* is represented we have a circle, and a projection of it may be made on a plane parallel to the axis of the cylinder, so that the outline will be a square or a parallelogram. If lines only are employed, such a diagram will give no correct idea of the true form of the object; hence it becomes necessary in representing a diagram of a cylinder, as of every other object, that due regard is to be had to the exhibition of it in such a form as to convey a clear idea to the mind.

An uninstructed person who, for the first time, attempts to make such a diagram, is disposed to make a circle for the top, and then continue lines to represent the length of the cylinder; and, under certain conditions, this may be done by a principle to which I shall shortly advert; I notice this because it has frequently happened, in the course of my experience, that I have seen a pit shaft represented in this manner—a method so fallacious, as to give the most erroneous impressions.

To explain this, I will suppose the shaft of a mine, ten feet in diameter and one hundred feet deep; we have thus a cylinder of which the length is *ten diameters*.

I will suppose that at the top of this shaft there are two roads, each one hundred feet long—one being direct north, and the other direct east, from the top of the shaft. Suppose also, for the sake of simplicity in form and dimensions, that at the bottom of the shaft there are two *drifts* or galleries, each one hundred feet in length and going in two different directions, namely, south and west. Let us suppose that the relative position of the shaft, roads, and drifts, is to be shown in a diagram.

The inexperienced draughtsman may, in the first instance, make a drawing representing the roads, the same as on an ordinary ground plan, with the top of the pit (or hollow cylinder) at the point of intersection, by a scale, say of ten feet to one inch. He then, by the same scale, proceeds to lay down the shaft in a perpendicular line, and the south and west drifts in their relative position to the north and east roads.

Now the fallacy of such a figure as would thus be made is apparent; although many persons can correct, by their own actual knowledge of the *true* relation of the objects, any practical error as deduced from such a diagram; the knowledge of the designer may save him from the error of the drawing, yet his diagram will convey no accurate idea to other persons.

We perceive, then, that every diagram must be designed in a certain relation to the truth, in order to convey correct ideas to others.

There are several methods of accomplishing this—

1. By a ground plan, or horizontal drawing.
2. By a sectional plan, or vertical drawing.
3. By an isometric projection.
4. By a parallel projection.

If the object to be designed or explained has relation only to one uniform plane surface, then the first of these modes is all that is required, but in every solid object the representation must depend on one or other of these methods of projection, unless perspective delineation is required. This does not come so much within the strict meaning of diagrams as generally understood, as of pictorial representation, which would introduce too wide a field for illustration in the compass of a lecture like this.

I consider diagrams, therefore, as being chiefly of such a nature as to require a close adherence to geometrical accuracy, and capable for the most part of being delineated by projection by parallel rays.

First.—*On a horizontal plane*, which, though it may be placed vertically, in order to be more clearly seen, is, nevertheless, so delineated as to represent a horizontal plane.

As, for example, a map of England, though placed upright against a school-room wall, is well understood to represent the nearly horizontal face of the country. Not so the geological sections or *profile* of railways to be found on some maps. These are to be delineated

Secondly.—*By parallel projection on a vertical plane*, and which, in like manner, is understood to be vertical, though lying flat on a table.

Both these modes are especially meant to represent one surface only; if different surfaces are introduced, they are all laid down in separate drawings by the plain rules which regulate this method of delineation.

Thirdly—When solid forms are to be delineated we may have recourse to *isometrical drawing*, which is best explained by reference to a cube, with a house and tower upon it; or

Fourthly—*By parallel projection*, based on the theory of shadows, by which a principle is afforded for a mode of delineation of great practical value.

Such being the general principles or methods upon which diagrams may be conveniently constructed, we come now to a consideration of the objects capable of illustration, and this will be found to include a range so wide as to be almost co-extensive with every department of human knowledge.

I shall first advert to *number*.—The most simple of all illustrations is that which represents a number by a space of length,

and its relation to other numbers by lines of comparative length, —a method of teaching addition, subtraction, multiplication, and division, which ought to be in use in *every* school. A line, one inch long, is drawn to represent unity, and its extension to five, ten, or twenty times; the division into two, four, or more parts, are readily shown and made clear by a diagram, and this principle may be either applied by single lines or by *bands* of moderate breadth.

When the transition from one period to another is gradual, single lines, representing the time of observation, may be used; but when quantity or number is *definite* at separate periods, *bands* of moderate width are proper.

In this manner may be clearly shown the number of inhabitants in a town or parish, or in several, say ten or fifteen, towns;

The actual number of children at school;

The proper proportion according to age; and

The rate, above or below such proportion.

In the admirable diagrams of statistics prepared by the late Mr. Fletcher, the element of number is shown by intensity of shading; the useful application of such diagrams to physical geography is apparent on inspection.

A further application of diagrams of number may be made in relation to time, and I exhibit diagrams of simple and compound interest, showing the value of three and five per cent. at both these rates.

The accumulation of funds at the same rates, viz. the amount of one pound in forty years, and of one pound per annum in forty years, as also the present value of one pound payable from one to forty.

These diagrams are of great use in illustrating simple and compound interest.

Another general application of diagrams is to represent space in relation to *area*; for as to mere extension, that is only the repetition of number. In areas we have to deal with a different mode of progression, and the *line* three times the length of another is the index to an *area* or square of nine times. Thus the relative size of the school-room may be compared with one square yard, one rood, one acre, one square mile.

The relation of one square mile to one hundred square miles.

The relation of one hundred square miles to a county or kingdom.

The relative size of England, Scotland, and Ireland in squares. This is easily done by taking the area in miles, the square root of which is the side of the proper square.

Then England or Great Britain may be made a scale of comparison for Europe, for land and water, and finally for the globe.

We may then proceed to represent the globe, and to illustrate its magnitude in comparison with that of the sun; and so, by a series of well-studied diagrams, carry the mind from magnitudes easily understood to those vast distances which can only be arrived at by steps of patient study, a process which is equally required in every department of art and science.

In considering *area* with reference to accurate divisions, we have to take into account the knowledge of scales, and to this the diagram No. 1, Surveying and Levelling, is especially directed, as showing and explaining the use of a barometer in a school, and the construction of the Vernier scales.

Such exercises are a useful introduction to a study of the properties of air, its pressure, &c.: and are, moreover, useful manipulations—the *very root* of exact measurement, and of a habit of *exact regard to dimensions*.

One great use of diagrams is to accustom the eye to general points of information. I may here especially mention and strongly recommend, the excellent and cheap diagrams of the Working Men's Association, examples of which are on the walls of this exhibition, and ought to be *very generally used in schools*.

Children accustomed to draw simple forms acquire a facility which would soon enable them to *multiply copies* of good diagrams from *copies* sent to a district; and as a proof of this, I exhibit numerous examples of geometrical figures, drawn by scholars at Allenhead's school, after a few months' practice.

Schoolmasters might be paid a moderate price for such copies, according to their merit, and copies of diagrams may easily be made on tracing linen; by these and similar means no difficulty would exist as regards providing diagrams. What is most wanted is a due appreciation of their use and value on the part of conductors of schools. They may with advantage accompany almost every part of education, being available in the very outset of arithmetic to explain numeration and other rules; the copying of diagrams greatly tends to improve writing; they convey clear ideas of relative time, and show the combinations of number and time. They moreover occupy the attention of children so as to develop a degree of attention; and a considerable acquaintance with astronomy, geology, and other sciences, may thus be made with a clearness and facility which, without such aid, cannot be attained.

It has been my wish, in the brief limits of this lecture, to direct attention to the greatly extended use of models and diagrams in general education. This subject is one which is scarcely at all understood in the great majority of the humbler class of schools.

I have endeavoured, by a few examples, to point out the useful aid which they afford to the teacher, the animation they impart to others in dry and uninteresting lessons, the awakening of *new* ideas in the mind, and the formation of correct habits of thought. All these show forth the value of such means of illustration in the school, but *here* their value only begins—for they establish, in the eye of the youthful student, an exact habit of observation which will be of the greatest use in every stage of life. Whether it be in the recreations of travel, in the pursuit of science or in following industrial occupations of any kind, however humble, scarcely a day can pass without affording some opportunity of applying the kind of knowledge which is thus imparted. In every department, from the complicated details of finance or other statistical conditions which claim the mind of the statesman, down to the occupations of the humblest artisan, well-constructed diagrams may be made the means of presenting, as it were, in one field of view—*combinations and relations of numbers, value, or space, in relation to time or other conditions*, in a way which cannot be done by mere figures or descriptions.

At no former time, or at no former place, could these considerations be more appropriately urged than in this institution, when, for the first time in the history of the world, an attempt is made to bring from different nations whatever tends to illustrate educational progress, and to present them in union with those which have been adopted in this country. A lesson of deep significance is thus afforded, for as surely as light surpasses darkness, and wisdom surpasses folly, so will this nation decline in power, in knowledge, in wealth, and happiness, if other nations proceed in a more steady application of sound and useful principles of teaching. The state of some schools, in retired places, is scarcely one remove from the darkness of barbarism—sounds with less meaning than the war-howl of the savage (for that has a terrible, and, to his foes, a well-known meaning), *sounds*, I say, *absolutely without meaning*, are learnt by children without one solid idea of meaning attached thereto. Even the slang phrases of the ragged children of utter destitution are not pronounced without a *meaning*, only too clear and lamentable. Yet day after day, week after week, month after month, the routine of the reading lesson goes on without any clear perception being formed as to what the intent and purpose of the words are. The habit of reading, regardless of the correct meaning, is a fatal blow to the formation of exact habits of thought. The ideas of such a mind continue to resemble the ruggedness of a marble block, instead of the exact and beautiful form which the chisel of the sculptor develops,—*not by adding one particle to that form, but by removing from it*

what is extraneous. So it is with the infant mind—the conversation of home and of companions, the observation of natural objects, and the necessity of *comprehending* much that is said, form a practical education, which in school ought to be continued by combining suitable explanations with all that is taught, and so rendering it available to future use. In this it will be found that verbal explanations alone are by no means sufficient; children are tired by prolix details; to already existing ignorance, carelessness and inattention are added. But when *actual objects* are presented to their view, when wonder and admiration are brought into play by new and curious combinations of form, the attention is willingly given, and the more this great advantage in imparting instruction and its value in after life is considered, the more will it appear that the cause of education may be usefully advanced by means of models and diagrams. These, more or less, are within reach of every teacher who will study the method of giving such instruction. The facilities now given by means of the Department of Science and Art, and which it will doubtless be one important object of the Society of Arts to extend by means of its journal and by its connection with institutions in various parts of the country, will, it is to be hoped, greatly improve the general character of school instruction. A solid impress of real and lasting utility may thus be given to education, tending to increase the happiness as well as the usefulness of every scholar, and to promote the best interests of this great country, which eminently depend on the intellectual skill, and on the sound religious and moral worth which are the true foundations alike of individual and national welfare and stability.

[This lecture was illustrated by a great number of models and diagrams, as well as by illustrations on the black board, of all which verbal explanations were given. These, if here repeated in detail, would require suitable woodcuts or engravings, but the general substance of such illustrations is as much as possible embodied in the preceding outline.]

ON THE USE OF COMMON-PLACE BOOKS IN SELF-EDUCATION.

By WILLIAM A. GUY, M.B. CANTAB., F.R.S.

The subject of this Lecture, if it commend itself to your notice at all, must do so solely on the score of its utility; for I am free to confess that it is destitute of all other attractions. I feel, however, that a subject which engaged the serious attention of John Locke is not likely to prove altogether unworthy of your notice. If he, with his profound knowledge of the philosophy of the human mind, and his habit of watching and analysing the operations of his own intellect, not only deemed it necessary to invent for himself a method of recording, in such a manner as to be easy of reference, the several items of knowledge which he was constantly acquiring by observation, conversation, and reading; but having invented such a plan for his own use, and found it to answer, thought so well of it as to be induced to publish an account of it, for the use of others,—if, I say, John Locke, with this knowledge and this experience, thought his common-place book worth describing, we, on our parts, shall probably find the subject of common-place books worth examining.

This, then, is one of my reasons for bringing this subject under your notice; for offering this contribution in aid of the good work which the Society of Arts has taken in hand.

Another reason which has influenced me is the extensive application which this orderly and methodical plan of recording facts, known by the name of "Common-place Book," has in the world of letters and science. Viewed in this light, this subject becomes one of universal interest; for there is no man, whatever his calling or profession, who does not find it necessary to commit to writing the knowledge which he has obtained by observation, conversation, and reading. The statesman, the lawyer,

the physician, the clergyman, and even the *littérateur* and miscellaneous writer, must adopt some orderly plan for committing to writing, and in a form admitting of easy reference, materials for treating the subjects which he finds to be important or interesting. Even the author of "Hudibras," if we may trust to the statement of Dr. Johnson, made use of a common-place book, in which he recorded, not merely the witty sayings of others, but the humorous ideas and droll images which were constantly presenting themselves to his own mind.

One other observation I ought perhaps to make, by way of preface, before I address myself directly to my subject. It has reference to the meaning of the words "*Common-place Book.*" The term is, perhaps, calculated to mislead; it seems to convey the idea of a very stupid and uninteresting performance, but it ought not to do so; for there is no analogy between a common-place *book* and a common-place *person*. The book may contain a rare collection of important facts, ingenious hypotheses, sound theories, happy thoughts, graceful expressions, and brilliant fancies, and yet be very properly named a *Common-place Book*. I can even imagine a lady's album transformed into a common-place book, in which each lady shall for herself, according to her own taste and fancy, arrange under proper heads the best passages from our great poets and prose writers, admitting the best anonymous contributions, on condition that they do not disgrace their company, and that their authors know enough of their meaning to place them under some distinct and defined heading.

I now proceed, without further preface, to the business of this lecture. I shall first give you a short description of Locke's system of Common-place Book, and then proceed to describe the plan which I advocate in its stead.

You will find a detailed account of Locke's plan in his collected works. It appears, from the title which it bears, that it was originally published in a French dress; and the correspondence respecting it is an example, at an early period, of that *entente cordiale* between England and France which is now exhibited on so grand a scale, and with such important consequences, in the East. The title of the essay is as follows: "A New Method of a Common-place Book, translated out of the French, from the Second Volume of the Bibliothèque Universelle;" and it is prefaced by a very modest and polite "Letter from Mr. Locke to M. Toignard, containing a new and easy Method for a Common-place Book, to which an Index of two pages is sufficient." As this letter is not very long, I will read it to you.

"At length, Sir, in obedience to you, I publish my 'Method

of a Common-place Book.' I am ashamed that I deferred so long complying with your request; but I esteemed it so mean a thing as not to deserve publishing, in an age so full of useful inventions as ours is. You may remember that I freely communicated it to you, and several others, to whom I imagined it would not be unacceptable; so that it was not to reserve the sole use of it to myself that I declined publishing it. But the regard I had to the public discouraged me from presenting it with such a trifle. Yet my obligations to you, and the friendship between us, compel me now to follow your advice. Your last letter has perfectly determined me to it, and I am convinced that I ought not to delay publishing it, when you tell me, that an experience of several years has showed its usefulness. There is no need I should tell you how useful it has been to me, after five-and-twenty years' experience, as I told you eight years since, when I had the honour to wait on you at Paris, and when I might have been instructed by your learned and agreeable discourse. What I aim at now, by this letter, is to testify publicly the esteem and respect I have for you, and to convince you how much I am, Sir, your," &c.

Now, I think you will agree with me in deprecating the terms in which Locke speaks of his "*Method of a Common-place Book.*" He calls it a *mean thing:* one which did not deserve to be published: a trifling matter in an age full of useful inventions. Though for my own part I do not think Locke's common-place book by any means on a par with his own high reputation, even when every allowance is made for the novelty of the invention. I am very far from deeming any practical scheme for saving scientific or literary labour deserving of being spoken of in terms of depreciation. Such schemes share with material instruments for abridging the labour of the human hand the two-fold merit of originality and economy; and they lay claim to be treated with a respect proportioned to the character of the labour which they abridge, and the value of the product of which they economise the production. In the case we are considering, the labour is that of the head instead of the labour of the hand; the precious product is intellectual and not material. Still, as I have just observed, I do not look upon Locke's method of a common-place book as being on a par with his reputation in other respects; and I think that when I have described his plan you will be of my opinion.

Let me first remind you, that Locke's common-place book is a book from the very first. It is not, as is the plan which I am about to advocate, a collection of loose papers gradually built up into a book. Perhaps the best plan I can adopt is to

let John Locke speak for himself, and describe his own method in his own words. He says:—

"I take a paper book of what size I please. I divide the two first pages that face one another by parallel lines into five-and-twenty equal parts, every fifth line black, the others red. I then cut them perpendicularly by other lines that I draw from the top to the bottom of the page, as you may see in the table prefixed. (Table 1.) I put about the middle of each five spaces one of the twenty letters I design to make use of, and a little forward in each space the five vowels, one above another, in their natural order. This is the index to the whole volume, how big soever it may be."

One would think, from this description, that a chief object with Locke was to economize paper. Every child can see that it would be better to give a page, or two pages, to each letter of the alphabet, with or without the five sub-divisions corresponding to the five vowels; and equally obvious improvements suggest themselves in the part of the book devoted to the entries. But to proceed:—

"The index being made after this manner, I leave a margin in all the other pages of the book of about the largeness of an inch in a volume in folio, or a little larger; and, in a less volume, smaller in proportion. If I would put anything in my common-place book, I find out a head to which I may refer it. Each head ought to be some important and essential word to the matter in hand; and in that word regard is to be had to the first letter, and the vowel that follows it; for upon these two letters depends all the use of the index. * * * * When I meet with anything that I think fit to put into my common-place book, I first find a proper head. Suppose, for example, that the word be EPISTOLA, I look into the index for the first letter and the following vowel, which in this instance are E, i. If in the space marked E, i, there is any number that directs me to the page designed for words that begin with an E, and whose first vowel, after the initial letter, is I, I must then write under the word Epistola, in that page, what I have to remark. I write the head in large letters, and begin a little way out into the margin, and I continue on the line in writing what I have to say. * * * * If I find no number in the index in the space E, i, I look into my book for the first backside of a leaf that is not written in, which, in a book where there is yet nothing but the index, must be p. 2. I write, then, in my index after E, i, the number 2, and the head Epistola, at the top of the margin of the second page, and all that I put under that head, in the same page. * * * * From that time the class E, i, is wholly in posses-

	a			*a*			*a*			*a*				*a*			*a*		
	e	4		*e*			*e*			*e*				*e*			*e*		
A	*i*		F	*i*		M	*i*		S	*i*				*i*			*i*		
	o			*o*			*o*			*o*				*o*			*o*		
	u			*u*			*u*			*u*				*u*			*u*		
	a			*a*			*a*			*a*				*a*			*a*		
	e			*e*			*e*			*e*				*e*			*e*		
B	*i*		G	*i*		N	*i*		T	*i*				*i*			*i*		
	o			*o*			*o*			*o*				*o*			*o*		
	u			*u*			*u*			*u*				*u*			*u*		
	a			*a*	12. 16.		*a*			*a*				*a*			*a*		
	e			*e*			*e*			*e*				*e*			*e*		
C*	*i*		H	*i*		O	*i*		U‡	*i*				*i*			*i*		
	o	14		*o*			*o*			*o*				*o*			*o*		
	u			*u*			*u*			*u*				*u*			*u*		
	a			*a*			*a*			*a*				*a*			*a*		
	e			*e*			*e*			*e*				*e*			*e*		
D	*i*		I†	*i*		P	*i*		X	*i*				*i*			*i*		
	o			*o*			*o*			*o*				*o*			*o*		
	u			*u*			*u*			*u*				*u*			*u*		
	a			*a*			*a*			*a*				*a*			*a*		
	e			*e*			*e*			*e*				*e*			*e*		
E	*i*	2. 10.	L	*i*		R	*i*		Z§	*i*				*i*			*i*		
	o			*o*			*o*			*o*				*o*			*o*		
	u			*u*			*u*			*u*				*u*			*u*		

* And K. † And J and Y. ‡ And V and W. § And Q.

sion of the second and third pages. They are to be employed only on words that begin with an E, and whose nearest vowel is an I,—as Ebionitæ, Episcopus, Echinus, Edictum, Efficacia, &c. The reason why I begin always at the top of the backside of a leaf, and assign to one class two pages that face one another, rather than an entire leaf, is, because the heads of the class appear all at once, without the trouble of turning over a leaf. * * * * When the two pages designed for one class are full, I look forwards for the next backside of a leaf that is blank. If it be that which immediately follows, I write at the bottom of the margin, in the page that I have filled, the letter V,—that is to say, VERTE, turn over; as likewise the same at the top of the next page. If the pages that immediately follow are already filled by other classes, I write at the bottom of the page last filled V, and the number of the next empty backside of a page. At the beginning of that page I write down the head, under which I go on with what I had to put in my common-place book, as if it had been in the same page. At the top of this new backside of a leaf, I set down the number of the page I filled last. By these numbers, which refer to one another, the first whereof is at the bottom of one page, and the second is at the beginning of another, one joins matter that is separated, as if there was nothing between them. * * * * Every time I put a number at the bottom of a page, I put it also into the index; but when I put only a V, I make no addition to the index; the reason whereof is plain. If the head is a monosyllable, and begins with a vowel, that vowel is at the same time both the first letter of the word and the characteristic vowel. Therefore I write the word Ars in A a, and Os in O o."

I have quoted Locke's very words, in preference to giving any description of my own, at the risk of your deeming me tedious. To render his account complete, it is only necessary for me to add that, in certain cases, Locke so far departs from his plan as to make new entries on right hand pages, if he finds them blank; that he advocates the plan of having several books, "one for each science, upon which one makes collections, at least two for the two heads, to which we may refer all our knowledge, viz., moral philosophy and natural; and perhaps a third, which may be called the knowledge of signs, which relates to the use of words, and is of much more extent than mere criticism;" and that, in accordance with the literary habits of his day, he expressed the heads in Latin. One other arrangement of Locke's I ought not to omit to notice, as it is highly characteristic of the man, and of the accurate habits in which he exercised himself. He says: —"To take notice of a place in an author, from whom I quote something, I make use of this method: Before I write anything,

I put the name of the author in my common-place book, and under that name the title of the treatise, the size of the volume, the time and place of its edition, and (what ought never to be omitted) the number of pages that the whole book contains.* * * * This number of pages serves me for the future to mark the particular treatise and the edition I made use of. I have no need to mark the place, otherwise than in setting down the number of the page from whence I have drawn what I have wrote, just above the number of pages contained in the whole volume." So that, by a simple rule of three calculation, the number of the page could readily be found in another edition of the same author.

I will not detain you longer by describing Locke's method of a common-place book, which I trust these quotations have sufficiently explained; but as I have given in Table I. a copy of Locke's Index, I will render the description complete by giving a specimen-page from the body of his book. (Table II.)

Such, then, is Locke's "Method of a Common-place Book," on the obvious defects and inconveniences of which I expressed myself in a paper read before the Statistical Society at the close of the year 1840, and published in the quarterly number of the Journal of the Society, for January, 1841, in terms which I must ask your permission to quote:—

"It is strange, indeed, that such a man as Locke, impressed with the value of method, should ever have adopted so imperfect and arbitrary a plan, or, having once adopted it, that he should not have improved upon it; for, surely, nothing can be more opposed to all method than the grouping of subjects together without any other bond of connection than an initial letter and a first vowel. * * * * The objection to Locke's "Common-place Book" is this,—that a number of totally different subjects are entered in the same page, or succession of pages, which subjects are held together by no other relation than that of an initial letter and first vowel. It is true, that so long as these entries are few in number, there is little loss of time in referring to them; but if they become very numerous, many pages may be passed in review before the desired passage meets the eye. But even this inconvenience is not of sufficient moment to require the adoption of an improved method, where each of the several entries refers to a different subject. It is only when a great number of passages referring to the same topic are scattered through a succession of pages that the inconvenience of this plan is severely felt. It was this obvious inconvenience which induced me to adopt the improvement of devoting a separate page, or series of pages, to each separate subject. But even here I soon found the same objection to apply which lay against the common-place book of Locke. As long as the entries referring

TABLE II.

SPECIMEN OF A PAGE OF LOCKE'S COMMON-PLACE BOOK.

ACHERON.] "Pratum, ficta mortuorum habitatio, est locus prope Memphim, juxta paludem, quam vocant Acherusiam, &c." This is a passage out of D. Siculus, the sense whereof is this: The fields where they feign that the dead inhabit are only a place near Memphis, near a marsh called Acherusia, about which is a most delightful country, where one may behold lakes and forests of lotus and calamus. It is with reason that Orpheus said, the dead inhabit these places, because there the Egyptians celebrate the greatest feast, and the most august of their funeral solemnities. They carry the dead over the Nile, and through the marsh of Acherusia, and then put them into subterraneous vaults. There are a great many other fables among the Greeks touching the state of the dead, which very well agree with what is at this day practised in Egypt. For they call the boat in which the dead are transported, Baris; and a certain piece of money is given to the ferryman for a passage, who in their language is called Charon. Near this place is a temple of Hecate, in the shades, &c., and the gates of Cocytus and Lethe, shut up with bars of brass. There are other gates, which are called the gates of truth, with the statue of Justice before them, which had no head.—Marsham. 259
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to any particular topic were few in number, my common-place book answered well enough; but when the subject began to occupy many pages, I found that if I wanted to make use of it, to digest the materials which I had collected, to analyse them, or to write about them, I had to re-arrange the whole, and to place extracts or facts of my own observing which related to one part of my subject, or threw light upon any isolated question connected with it, by themselves, that by viewing them in connection I might better understand their bearing, and estimate their value. Thus, the original labour of inscribing the several extracts or facts in my common-place book had to be repeated with regard to all those parts of my subject to which I was induced to pay particular attention. To place the inconvenience of this method in a strong light, I may instance one subject which occupies upwards of sixteen closely written pages in a large quarto volume, contains upwards of 250 quotations, abstracts, facts, or references, and embraces almost every topic of interest connected with it. With all the assistance derived from the marginal references, much time must necessarily be lost in selecting the quotations or facts referring to any one symptom observed, or remedy employed, or bearing upon any disputed point; and it is obvious that the information collected could only be made available by being re-arranged, whether for my own information or the instruction of others."

The improvement which I have referred to in this passage,—at least as far as the index is concerned,—is carried out in the *Locke's "Common-place Book"* published by Messrs. Walton and Maberly, of Gower-street, in 8vo. and 4to., with printed directions for use.

I may also mention in this place that a TODD'S "INDEX RERUM," also accompanied by printed instructions for use, has been published by Mr. Kennett, of York-street, Covent-garden. This consists of an index running through a manuscript book with a number of pages given to each letter of the alphabet proportioned to the frequency of the occurrence of that letter in names or subjects. These pages are intended to be portioned out among the initial vowels, as in Locke's plan, and the entries are made on the pages corresponding to the initial letter and first vowel of the author's name or subject. I need not say that this book, though very convenient, shares the defects of Locke's method; and neither these nor any analogous plans can be said to be of any service in self-education. In using these methods there is no necessity for any other exercise of the mind than that which is required to determine the initial letter and first vowel of some leading word which would prove suggestive to the owner of the common-place book of the quotation or other entry of

which he might happen to be in search, and thus enable him to turn to it. The plan, on the contrary, which it is the chief object of this Lecture to describe and advocate, is one which requires at every step the exercise of the mind in a useful work of analysis. Instead of being a book from the first, my common-place book differs from others in being gradually built up with loose papers. In describing this method, it will be necessary to begin with an account of these loose leaves.

The loose leaves are all of one size, and are uniformly ruled with three *horizontal* lines at the top of the page, and with three *vertical* lines at the left-hand border. On the first of the *horizontal* lines, and at the right-hand corner of the leaf, the *Subject* is to be written; on the second line, and a little to the right of the centre, the *Subdivision of the Subject;* and on the third line, the particular proposition, hypothesis, theory, &c., which the entries in the body of the paper are intended to illustrate. The leaf bearing any such proposition, hypothesis, theory, &c., is henceforth devoted to the illustration of that proposition, hypothesis, theory, &c., and of none other. Of the *vertical* lines, the one nearest the left-hand border bounds a space left blank for the spring of the portfolio; between this and the second vertical line, a wider vertical space is enclosed for brief references to the contents of the entries. The narrow vertical space between the second and third lines is for numerals marking the number of the entries. (*See* Table III.) Each page, as I have said (including, if you please, the back of the page, to which any unfinished entry may be conveniently carried over, taking care, of course, to leave without writing the portion of paper left blank for the spring), and, if necessary, a succession of pages, with the same headings, and numbered 1, 2, 3, &c.,—each page is devoted to one single proposition. This is the most important feature of the plan; it is this which constitutes its chief recommendation. You cannot thus devote a paper to a single well-defined proposition without thinking what that proposition shall be. In seeking out an appropriate heading, you are compressing into a small compass the meaning of all the entries to be found beneath it. I will give you a few examples. I will suppose that you are reading a book of travels,—a book which you may never wish to refer to again, and which, if you did wish it, you might not be able to procure; and that you are struck with some passage which you wish to preserve. Let us suppose further, that the passage relates to some subject in which you take an interest, and in illustration of which you would wish to accumulate materials. In the example I am about to adduce, the subject is the influence of the mind on the body, or inversely, of the body on the mind, and the book of travels an obscure work by an author of the

TABLE III.

SPECIMEN. SUBJECT.

SUBDIVISION OF SUBJECT.

Proposition, Hypothesis, Theory, &c.

Spring.	Short References.	Numerals.	

TABLE IV.—INFLUENCE OF THE MIND ON THE BODY.

Of the Imagination on the Senses.

Sense of Sight.

Ingenious mode of detecting a thief.	I.	The Kamtschadales have a firm belief in the supernatural power of the Schamans. "A Kosak once profited by this credulity to regain his stolen property, in a very ingenious manner. While on a journey with several Kamtschadales, he had some of his tobacco stolen from him; and after questioning each individual separately, he was unable to discover who was the thief. He accordingly took some sticks, and making them of equal lengths, gave each of them one, with the assurance, that the stick of the thief would infallibly grow longer by the power of Schamanry. This unpleasant intelligence had such an effect on the imagination of the thief, that he actually conceited that his stick did increase in length, and thought to relieve himself from this dilemma by breaking a piece off. The next morning every Kamtschadale carrying back his stick, the thief was discovered."—*Sarytschew's Travels*, p. 68.

name of Sarytschew. The passage in question runs as follows:—"A Kosak once profited by this credulity (the belief of the Kamtschadales in the supernatural power of the Schamans) to regain his stolen property, in a very ingenious manner. While on a journey with several Kamtschadales, he had some of his tobacco stolen from him, and, after questioning each individual separately, he was unable to discover who was the thief. He accordingly took some sticks, and making them of equal lengths gave each of them one, with the assurance, that the stick of the thief would infallibly grow longer by the power of Schamanry. This unpleasant intelligence had such an effect on the imagination of the thief, that he actually conceited that his stick did increase in length, and thought to relieve himself from this dilemma by breaking a piece off. The next morning, every Kamtschadale carrying back his stick, the thief was discovered."

Now the subject which this quotation illustrates, and to which it naturally belongs, is the influence of the mind upon the body; and the subdivision of that subject, to which it as obviously relates, is the influence of the imagination, by whatever cause (whether fear or conscience) excited, on the senses. The particular sense affected (and this determines the third heading) is the sense of sight. The entry of this passage on one of the loose sheets would therefore assume the form of Table IV.

You will easily understand that it is not always necessary to head the loose leaf with the principal subject, the subdivision of the subject, and a distinct proposition, as in the example I have just given. In the case of this very anecdote, it might suffice to omit the third heading altogether, and to enter on the same page all that relates to the influence of the imagination on the senses, specifying the particular senses affected in the narrow column of short references at the side. Supposing, for instance, that, in the course of our reading, in conversation, or otherwise, we happened to meet with an account of the English farmer who adopted an analogous method of detecting a thief, namely, collecting his farm-labourers, and setting them to work, stirring up a sieve-full of feathers, assuring them that the feathers would certainly stick to the head of the thief. The experiment had not lasted long before one of the labourers kept raising his hand to his head, so as to cover it with feathers; and thus he betrayed himself as the depredator on the worthy farmer's corn-bin. We should enter this new illustration of the influence of the imagination on the senses on the same paper with the anecdote from Sarytschew's travels, and we should write in the narrow column of brief references the words "*On the Sense of Touch*," having distinguished the first entry by the words "*On the Sense of Sight*."

That other well-known anecdote of the ingenious Indian mode of detecting a thief would form, in like manner, the first entry under the same subject and subdivision, but with the distinct third heading of "*On the Secretions.*" The suspected Indians are all made to chew a small measure of rice, and after a time to spit it out on a plantain leaf. The unmoistened rice from the mouth dried up by fear, convicts the thief.

I will take another and different example. I will suppose that I am interested in that mode of discovering truth which consists in collecting, tabulating, and analysing masses of facts,—in other words, in what people have got into the habit of calling "*Statistics.*" We should certainly meet with a large number of passages depreciating statistics, and pointing out the difficulties, fallacies, and objections to which that method is exposed; and we should also encounter many explanations of the meaning of the word "*Statistics.*" Now this is a very good example in point,—a very good illustration of the advantages of this plan. Let us suppose that, from time to time, we meet with meanings of this term, or with passages explaining such meaning. According to Locke's method, such passages would become mixed up with all sorts of quotations relating to all sorts of matters indicated by words beginning with *S*, and having *a* for their first vowel; and the same inconvenience, to a less degree, would attend the use of an improved common-place book, in which a page, or several pages, is devoted to the same leading subject. In lieu of this inconvenient confusion, we should have a page, or a succession of pages, given up exclusively to the passages illustrating the meaning of this word; and we should probably have a separate page, or succession of pages, devoted to those passages from the old English authors, in which the word *statist* is used in the sense of statesman, and the word *statism*, or *statisme*, in the sense of political economy, or statecraft.

Having now sufficiently described the loose leaves of which my "Common-place Book" is made up, and the mode of making the entries upon them, I proceed to describe the successive steps of the process by which the loose leaves are made up into a book.

The first loose leaf, containing an entry referring to a particular subject, is placed in a portfolio, formed by folding half a sheet of thin cartridge paper, and writing upon the outside of it the name of the subject either in ink or pencil. All the loose leaves having entries referring to the same subject are to be placed in this same portfolio, and there kept till they become numerous. When the loose papers have become so numerous that time is lost in searching among them for any particular subdivision, they are to be distributed through several similar

Science.	History of, and of scientific discoveries...	*a*
„	Definition	*b*
„	Objects and applications	*c*
„	Its pleasures	*d*
„	Its advantages	*e*
„	Obstacles to its advancement.....	*f*
„	Means of improving and advancing	*g*
	&c. &c. &c. &c.	

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portfolios, on the outside of which the principal subject, and the subdivision to which the portfolio is devoted, are to be written. These thin portfolios, each containing its own subdivision of the subject, are then to be placed in a cover, bearing on the outside the name of the principal subject.

When the portfolios of stiffer cartridge paper, thus enclosed in their covers, have themselves become numerous, and their contents bulky, they may be made into a book, as follows :—

The loose leaves contained in each portfolio are to be arranged in order, and placed before one of twenty leaves of stout paper, bearing a letter of the alphabet, which I may call INDEX-LEAVES. This being done with all the index-leaves in succession, the several subdivisions are written upon a TABLE OF CONTENTS, consisting also of stout paper, and of such a size as to leave the letters of the index-leaves uncovered ; which table of contents is inscribed with the twenty letters of the alphabet printed on the index-leaves. This table of contents bearing the several subdivisions of the subject written opposite the several index-letters, we have only to note the letter of the alphabet opposite the entry on this table of contents, and to turn at once to the same letter on one of the index-leaves, in order to find all that we have accumulated in reference to the subdivision in question. The loose leaves are contained between that index-leaf and the preceding one. (Table V.) All the loose leaves having been thus arranged, each subdivision having its own index-leaf and its own entry in the table of contents, the collection of loose papers is made up into a book by means of the portfolio furnished with a spring. The name of the subject should be printed on the back of the portfolio, which may then be placed on the book-case.

Having thus described the method which I recommend for gradually building up a Common-place Book out of loose leaves, let me briefly state what I conceive to be the peculiar advantages of this method. They are four in number :—1. It is not possible to use it without thinking of the exact meaning of every entry which is made. 2. The same proposition, with all its illustrations, is always kept distinct and separate from all others. 3. The book may easily be taken to pieces, and any part of it carried about for use. 4. An experiment of the plan may be made at the trifling cost of a packet of ruled papers and portfolios.*

* Since this Lecture was delivered, the Messrs. Street, of 11, Serle-street, Lincoln's-Inn, have taken in hand the sale of the "Loose Leaves" and of the "Common-place Book." They have made up packets containing fifty ruled loose leaves, five thin and one stout portfolio, with

I ask your permission to describe these advantages a little more fully, by quoting a passage from the Essay in the *Statistical Journal* already referred to.

"Such are the principal features of a plan which I have myself adopted, after some experience of the defects of Locke's system of Common-place Book, even in its most improved form, and which I venture to recommend with confidence as a means of economizing time, of encouraging habits of order so essential to clearness and precision of thought, and of heaping up materials always ready for use. I know indeed of no means by which reading is likely to be rendered so profitable as by the reflection which must be exerted on every fact as it is thus arranged in its proper place, and in due relation to others; and I know, from actual experience, the great superiority of a method which implies the constant exercise of reason and reflection over that which, consisting merely in transcribing the thoughts of others, is but too apt to convert the man of learning and science into a mere amanuensis.

> "He who reads
> Incessantly, and to his reading brings not
> A spirit and judgment equal or superior,
> Uncertain and unsettled still remains,
> Deep versed in books, and shallow in himself."

And these lines apply with equal force to him who writes incessantly without digesting and arranging that which he transcribes.

"The mental training implied in the employment of such a method as that which I have described, the necessity of ascertaining the precise meaning and scope of every passage committed to paper, and of expressing it in the fewest possible words, form the chief recommendation of the plan which I propose. Another advantage which it possesses over the ordinary forms of Common-place Book, is the close correspondence of the method itself with the mental process by which sciences are built up. First, a single fact is observed, then many others resembling it in some general features; then, with accumulation of observations, confusion, and an effort at subdivision; then the formation of smaller groups; and, lastly, the re-union of the several groups with others formed by a similar process, and the construction of separate sciences. * * * I will only add, that

the method is equally applicable to science, learning, and literature. The scholar may collect passages in illustration of disputed points in philology; the historian may bring together the scattered materials of history; the author in the lighter walks of literature may cull the flowers of fancy, or the gems of wit; and the divine may heap up his treasures of sacred learning; and each will find such materials as he possesses readily available for the purposes to which he wishes to apply them."

ON INDUSTRIAL SCHOOLS*.

By JELINGER SYMONS, B.A. CANT.

IN venturing to address you on a subject so largely canvassed as that of industrial education,—and one on which opinion widely differs,—I think it right, as I am one of H.M. Inspectors of Schools, that I should preface what I have to say, by begging you to receive my own notions upon my own responsibility,—as divested of any official character,—and in no degree as compromising or expressing the views of the Lords of the Committee of Council on Education.

In speaking of "industrial schools," I need scarcely premise that I refer almost entirely to the education of the children of the labouring classes,—a subject which (though long discussed) I am sure you will agree with me events are daily pressing more urgently on our attention, and which is second to none in social importance. The subject of industrial instruction united with schools is comparatively of recent origin; and I cannot but attribute the increasing notice it obtains—First, to the desire that education should be so good and popular as to be self-supporting; and Secondly, to the hope entertained by many, that industrial instruction may prove a means to this end, by adapting the education given more closely than is now done to the practical wants and labour-life of the classes to be educated. Whether rightly or wrongly, I have not sufficient evidence to determine, but sure it is, that a very widely-spread notion prevails—entertained by various ranks of persons—that the present education given in common schools is not sufficiently of this character; and that a thorough comprehension of elementary and suitable learning is often sacrificed to scholastic subtleties, and high

* One or two passages omitted when this Lecture was read are inserted here.—J.S.

subjects, apprehended by a few only, and of practical usefulness to none of the scholars. And I must confess that whenever I find scholars well-grounded in such religious and secular knowledge as cannot fail to be of use in the homely duties and daily labours of life, and more especially when I find the school so organized that what they thus learn, can be practically applied, I am very tolerant of the absence of all knowledge of technical theology, or high art, and am nowise dismayed if I find the children know nothing of the chronology of the kings of Israel—are ignorant of the tributaries of the Euphrates—and never heard of Agamemnon. It is, in my humble judgment, a far graver blot when they are unable to give the practical moral of a parable—to describe the productions and topography of their own country—to explain intelligibly any one of the common arts of life—the qualities of metals, or the uses of timber trees, or to exercise the powers of mental calculation. Unless this be done, and well done, and unless this, and much more of the same kind of knowledge, be diligently imparted (as far as the age, stay at school, and capacities of the children permit) not merely to the few clever and forward children who figure in the first class, but fairly among the whole number, a school certainly does not fulfil the requirements of the working classes, or satisfy even the lowest standard of instruction desired by those who are most concerned for their welfare. And assuredly, none such have the least chance of being self-supporting.

But in whatever degree schools are rendered practically efficient for the purposes of education, in the full ing of that term, sure it is that to that extent are they lik o pay their way. The poor are, in some measure, good judge this matter, for they in general look closely to the value of at they pay for. True it is that they have hitherto held schoo nstruction at no very high estimate, nor is it certain that they h e erred much in so doing.

Dean Dawes, and many worthy coadjutors, have done much to meet the evil, by showing how *in*-door school instruction may be improved; but I have for long thought that there remains another branch of the work to be achieved ere education shall be complete. The human animal is physical as well as mental and and moral, and so intimately does all philosophy and all experience show that these elements of man are *blended*, that the education of no one of them can be safely neglected. If it be, the work is incomplete, for the cultivation of any one alone suffers from the disjunction.

I am disposed to believe that more real good is done for a child by the joint training of *all* his faculties, even in a low measure, than by the highest intellectual instruction exclusive of

physical and moral training. It was the great bane of the old school system that it did thus disproportionately instruct the mind—I speak even of the best schools. Not a word need be wasted on those mechanical mockeries of education which merely encumber the memory and neglect the understanding, teaching nothing effectually but the mechanism of writing, reading, ciphering, and religion by rote. But the question still remains, whether the great majority of schools are good enough to satisfy the ordinary requirements of the times—and *sufficiently educate the child*, however fully they may *accomplish the intellect*.

Is it possible to give even a fair start to the moral or physical development of a being so full of animal life and propensities as a child, whilst cabined in a school-room, harnessed to its routine, and constrained by its discipline? The real nature of the child has no free scope within the four walls of a school-room, and its very virtues there are chiefly negative and conventional. Its vices have small means of display, and consequently small chance of correction. I am far from disposed to underrate the mental benefits achieved, but can the best qualities of the *heart—love, generosity, mercy, forgiveness, moral indignation at the meaner vices*, courage or truthfulness be brought fairly into play. But set those same children to work out of doors, or even turn them into a play-ground, and their nature comes out, and with it ample scope for moral training, the suppression of what is mean and vicious, and the encouragement of what is generous and good. Mr. Stow, of Glasgow, has written well and wisely on the indispensability of this right hand of the educator. He insists, however, as I think rather too exclusively, on the *play*-ground; and has left to industrial schools the privilege of developing the greater efficacy of the *work*-ground, especially in those branches best adapted to schools for the labouring classes.

Before entering more at large on the direct effect of industrial training on industrial life, permit me to touch on the indirect furtherance which I think it gives to practical instruction in the school-room, and especially to that branch of it lately very happily termed the "Science of Common Things." I believe that if there be—as there always ought to be in these branches of study—an intelligent adaptation of the subjects taught within, to the work done *without*, and that the scholar is made to perceive the application of what he *learns* to the work that he *does*, there will necessarily arise in his mind a life-like appreciation of the practical value of knowledge, which will materially aid its acquisition. It makes his lessons a reality, of which he apprehends the meaning and feels the use, instead of an abstract jargon, which, being unable to apply it, and having little hold on his senses, he learns without benefit and forgets without loss.

I venture to think, from the experience of the schools of this kind in the best workhouses in my district, that the teacher is also proportionably aided by this experimental instruction, which labour imparts to mind, and which undoubtedly mind reciprocates to labour. I have found that it greatly facilitates the teaching as well as learning of practical science, and if more generally adopted, would, I am sure, remove many of those defects in tuition such as caused Mr. Moseley to say, in his last report, that, "The tendency from ignorance of *things* to teach children *words* only runs in a notable manner through almost all the lessons on physical science which I have listened to. It will not be eradicated (he adds), so far as the teaching of popular science is concerned, until the study of physical science shall be more systematically pursued in training schools, *or until it shall have received a special application to those things surrounding the daily life of a child, the science of which is within the limits of its comprehension;*" and I would add, more especially,—such things as lie within the range of his actual work.

Most true is it, as Mr. Moseley afterwards says, that "labour, without thought or contrivance, for no object, to which our endeavours are directed, and which we adapt to no end, is irksome to us."

The reverse of this proposition is almost equally true, for irksome indeed is the acquirement of knowledge which a child is not taught to apply to any practical purpose. Mr. Moseley continues: "To develop this character of the *makers* in the child, as contrasted with the *workers*, is the function of physical science in elementary education. It is to lay the foundations of intelligence, enterprise, activity, and industry in the common affairs of life, and of all those elements of a man's social and moral well-being which stand in intimate relation to these." I regret, however, to find that so high an authority holds this to be "industrial education *under its only reasonable form*." And Mr. Moseley adds that actual industry for children presents, to his mind, visions only of "monotonous occupation, strained nerves and sinews, stagnant impressions, hatred of labour, and premature discomforts forbidden by nature!"

I entertain so great a respect for the opinion of Mr. Moseley that I should feel considerable diffidence in expressing the strong opinion I have been induced to form, in favour of rational and appropriate bodily labour for children at an early age, were I not relieved by a foot-note on the same page of his report, which points to the fact that Mr. Moseley had chiefly the trades of *shoe-making* and *tailoring* in view when he wrote these remarks, trades which, I have no difficulty in believing, that the Greenwich School-boys very sensibly abandon for better and more

lucrative employment in after-life. If, however, Mr. Moseley, or any of my hearers, will follow my example this morning, and pay a visit to the farm-school at Highgate, and see the boys at work at their various occupations on the land there, all such forebodings will be rapidly dispelled by the unmistakable evidences of high animal spirits, cheerfulness, the healthful and strengthening nature of spade husbandry, and the intelligent interest in—as well as the instructional and suggestive character of —the work done. There is no answer to any such misgivings half so complete as that of one's own personal observation. I have seen too many inert, flaccid, feeble, children in workhouses converted under my own eyes, by such means, into hardy, healthy, handy little labourers, to entertain any doubt of the immense benefit of muscular exertion and useful work alike on the physical and moral nature of a child. One of the first lessons I strive to teach my own children, both by precept and practice, is the value and dignity of labour, and the full use of their hands as well as their heads; and I do not scruple to recommend systematic bodily industry as a concomitant of education for children of the higher ranks. Athletic games and manly exercises in some cases and in some measure achieve this object, but by no means universally or sufficiently. It is worth notice, that though men who unite ornamental accomplishments with bodily inactivity, are numerous, few men have ever excelled in the nobler aims and great energies of life, who have not evinced physical training and bodily vigour.

To children who are to earn their bread by the sweat of their brow, it is almost impossible to exaggerate the importance of associating manual with mental labour, at an early period: and this cannot be done if habits of bodily industry are postponed to a later period. The spirit of the labourer cannot be imparted without labour. I do not believe that Solomon's golden maxim, "to train up a child in the way he should go," was intended to be applied only to morals and minds, but to all the great duties and behests of life—physical as well as mental. Habitual industry in childhood would have prevented three-fourths of the idleness, dependence, disease, and pauperism, of which a grievous amount still exists, and rankles like a canker among the poorer classes of this busy country.

Allow me now to dwell for a moment on the direct influence of judicious bodily industry in the development of mental power. It is the all but universal testimony of the teachers and inspectors of those schools which have adopted out-door industry, especially in spade husbandry, that the boys so employed learn far more readily than they formerly did: and that although their time is shorter in school, they learn more quickly whilst there. It is equally so with respect to moral habits.

The more fully habits of neatness, intelligence, patience, and industry grow under the discipline in the ground, so surely are the same qualities apparent in the school. "The best workers in the ground," says Mr. Adams,* "become the best learners in the school: and if a boy has a slovenly, ill-cultivated plot in the land, he is sure to be a slovenly, idle fellow in the school, until he is reformed."

And I must here mention an important illustration brought to my notice of the assistance which out-door industry gives to the fruition and exercise of kindly sympathies between boys. I allude to the mutual assistance it involves. In the ground, the boys not only work together, but they help each other. The whole system instils a practical habit of mutual aid and co-operation. In the school-room, it is exactly the reverse. The help given by one boy to another, which is a duty in the labour-ground, is an offence in the school-room; for there, each must work by, and for himself. I was told that when any emergency occurs in the cultivation of the ground at the Highgate School, it is common for the boys who have left the establishment, to come and volunteer a half-day's work to help the others, although they have no longer a prospect of reward for it; and the other day, when some visitors from the Exhibition were expected at the school, and the little boys could not get their plot so neat as they wished, the elder ones, of their own accord, turned to and helped them. I need not dwell on the genial and fruitful effect which a work tending to such results, simple as they are, must necessarily exercise in removing selfishness, and fostering those feelings of brotherly love and benevolence one towards another, which are the highest practical test of Christianity.

Mr. Watkins says, in one of his reports, speaking of the few experiments yet made in the West Riding:—"I believe it is hardly possible to overrate either the *moral* or the *economical* value of school-fields and gardens in manufacturing, quite as much as in agricultural districts of our country." He sums up the advantages thus:—"The willingness of the children to work; the healthy effect produced on their work in school by their work in the garden, *shown by their standing in the school, and conduct in it.* To these," he well says, "may be added, the practical knowledge acquired by these young gardeners of a subject which will be useful and interesting to them in whatever situation of life they may be placed, the cultivation and refinement of their tastes by more observant acquaintance with the wonderful and beautiful works of Nature; and above all, the habit of healthy industry and cheerful occupation of time which

* Master of the Highgate National School.

will, by God's blessing, save them from many a temptation, and support them in many a trial of their after-life."

There is much practical truth in this. The physical concomitants of a child's existence greatly determine his moral character and status hereafter, as well as in childhood.

Having now touched on the general principles whereon industrial schools are advocated, it may be permitted me to say something of the details of the system.

The kind of labour taught must always be judiciously adapted to the kind of employment most suitable and accessible to the scholars in their locality, as an introduction to the business of after-life. Thus, the employment must greatly depend on the circumstances of each case.

Of course, in towns, resort must be had to the more useful trades, on which I will say a word or two presently; but as the great majority of schools for the poor are either in or near the country, in a large majority of cases, nothing excels spade husbandry for boys, with the care of pigs, and wherever possible, of cows, chiefly stall-fed, the land being cropped and manured accordingly. Household and needle work are excellent occupations for girls, but to these should be added washing, ironing, and—where it can be done—cooking.

Let me, however, at once disclaim the error that by such industrial training as it is alone possible to give school-children, it is pretended that we can make them perfect gardeners, husbandmen, cattle-keepers, dairy-women or domestic servants; but it is affirmed that they will acquire an aptitude for useful labour and habits of manual industry, which are not, and cannot be acquired in school-rooms. It is also (I beg to repeat) a most important fact, that they who stay long enough are thus serving an apprenticeship, whilst at school, in those after-pursuits and modes of livelihood which they must eventually learn; but which they must must defer in ordinary schools till they quit them.

It is, indeed, advanced against the junction of industry with school instruction, that the parents of working-class children will take care that they shall be put to work quite soon enough to learn it properly; and that it is a pity to withdraw any of the short time now allotted to them for the education of their minds.

To this position there is the short, and it seems to me sufficient answer, that the parents put their children to work often far too early, and that they are now compelled to take them wholly from school in order to do so: whereas it is the great virtue of industrial schools that by *the early adoption of productive labour along with school instruction*, they are induced to allow their children to remain there longer than they otherwise would.

Under the purely mental school system, one of two evils seems inevitably to arise from the necessities of the poor: either instruction is unduly shortened, or labour is injuriously deferred.

Why are poor parents so anxious to remove a child of eleven or twelve years of age from ordinary schools, just at that very period when his faculties are expanding, and it is of the most vital benefit to him to continue his education? It is in order that this very apprenticeship to labour may begin, which the industrial school gives, but which the ordinary school prevents. There is something more than theory to back the assertion that industrial schools will retain children longer than others, and therefore afford one of the best remedies to that shortness of the stay of poor children in school, which militates so fatally against adequate instruction in every part of this busy nation. Let me name some examples.

In the Hagley School, Lord Lyttelton has adopted spade-husbandry and carpentering as collateral pursuits. The school fee is threepence per week, and the average duration of the stay was three years, during the last few years; and the number of children in the school in April, 1853, above twelve years old, was thirty-one out of 119. At Hereford there is a Blue Coat school (most efficiently taught) which, in July last, contained exactly the same number of boys. There is no industrial training: *the instruction is wholly gratuitous*. The average duration of the stay is two years, nine months and a half for the last three or four years; and the number of boys above twelve years old was, in July last, only ten out of 119—the same number as at Hagley.

At the Llanelly School, attached to the copper works (not industrial), but also an exceedingly good one, the average stay, including those now in the school, is one year and eight months, the average school-fee being only three-halfpence per week. The census of education, grossly erroneous as it is, shows truly enough, that two years is about the average duration of schooling which poor children receive.

If the ordinary schools for the poor were similarly tested, it would be found that the average duration of the stay of the children is still less than this in busy towns.

In the Hagley School, there is no other inducement to the parents to let the children remain a longer time than its greater usefulness to them. This is the true secret of the matter. Here, in spite of double the cost, the parents make the sacrifice for double the time, because, and only because, it is worth their while to do so. Render the schools equally worth the sacrifice elsewhere, and the parents will as readily make it everywhere. The children are to fill certain stations, and perform certain

labour. They require to be fitted for both. Education must do this, or it fails in doing what it is designed for; or, at best, does it partially. It is found that industrial schools effect this the best. Hagley is not a perfect model of this kind of school, but it illustrates the ease with which the industrial system may be carried out, and the great benefit which even an imperfect application of it is capable of effecting. The school is pleasantly situated in the village, and is under the charge of a very efficient teacher. Apart from the carpenter's shop, patches of ninety-eight square yards of ground are allotted to the boys (eleven years of age) who deserve them most, and are likely to stay at the school. They cultivate them entirely themselves: the master merely giving hints. They pay no rent for the ground, and have manure gratis. They buy their own seeds, and *have all the produce*. This is essentially requisite to the success of the system. There are cases in which the schoolmaster receives the profit for his trouble: others where it goes to the school-fund. None of these answer. The parents will not let their children give that labour for nothing, which they can themselves turn into money. It leads to the failure of the scheme, inevitably. But when to the faculty for industry are added its fruits, be they ever so small, there is a charm in the plan which wins ready suffrages from the parents.

At Highgate this fact has been well evidenced: the *boys* obtain small plots of land, of about three poles, at a rental of two shillings yearly: these they cultivate out of school-hours at their own expense, receiving superintendence and sometimes seeds from the master. In addition to this they give at least one hour's labour to *his* land, and for extra time they receive one penny per hour. The parents are well satisfied with this advantage, small as it seems.

The *day* girls, who are *not boarded* with *the others*, are required to assist in the household work taught to the boarders, and if not paid for it, they usually object, and their mothers interfere and find out that they cannot dispense with their assistance at home. I never knew it otherwise; and I should be sorry if it were. It is due to the parent, and due to the children, that in all dealings with them there should be the earliest homage done to the great principle—that "the labourer is worthy of his hire."

In the country there is not much choice of handicrafts, but that of the carpenter. It can be pursued in wet weather, is cleanly, exercises the muscles and teaches handiness perhaps better than any other of the labouring arts.

Mr. Norreys speaks in the highest terms, in his last report, of the success of the industrial schools he has promoted in his district, and especially of the experiment made in a few places, to

let the boys divide their time between work for the neighbouring farmers and school instruction. It appears to answer admirably; and Mr. Norreys adds these, among other important results:—"The longer period of schooling which by this compromise the parents, farmers, and guardians, are induced to consent to, more than compensates for the loss of a few hours of each day. The alternation of field-work with school lessons, gives zest to the latter."

It is well to cite evidence also from the schoolmasters. Take the letter of Mr. Joseph Radclyffe, of Upper Slaithwaite, Yorkshire, as an illustration in Mr. Watkins's report (p. 497):—"I have been highly gratified in my vocation as cultivator of the school field-garden; the children have willingly gone to work whenever they have been called upon, looking so full of energy that they have had the appearance of men when seen labouring in the distance. Beyond a question, it would do well for schoolmasters and school-children generally, had they each and all plots of ground for their own recreation and profit." In this one-acre ground, Mr. Radclyffe reports a produce exceeding the outlay by 6*l.* 6*s.* 8*d.*

The successful establishment of industrial schools in towns is more difficult than in the country, inasmuch as spade husbandry is rarely practicable there. All that can be done for the boys must be by means of workshops, as in the free industrial school at Birmingham, where they nearly clothe themselves, and are consequently made tailors and shoemakers. In many cases I think that bookbinding, and, in sea-port towns, net-making may be advantageously taught. Carpenters' shops may always be added beneficially. As regards the industrial training of girls, the matter is much easier.

The great point is to discourage all kinds of frippery and fancy work. It is utterly unsuitable for nineteen-twentieths of the class who are taught in our common schools, and who cannot all be ladies' maids. It runs side by side with some of the extravagances in mental instruction to which I ventured to allude before, as regards the teaching of boys, and tends, especially in the girls, to feed vanity, and utterly unfit them for being domestic servants. In sympathising, as I most heartily do with the strong outcry now raised on this subject, I am confident that I am consulting the real comfort and feelings of the children themselves, who frequently suffer most bitterly in after-life from the puppyisms of education to which they have been thus subjected. I may be forgiven, perhaps, for introducing a trivial anecdote here to illustrate this. A girl in Devonshire was sent to a national school, in which she had been taught her parts of speech after a fashion, but certainly not how to boil potatoes, or any single qua-

lification for the service into which she shortly afterwards entered. She was found to be as useless as might be expected, but her mortification was perhaps quite as great to find that her flimsy attainments were the cause of additional annoyance to her. As a specimen, she was asked by one of the young ladies in the house how she liked the master at her school, who occasionally stuttered? She replied that she liked him very well, except that he was not *affluent*. This caused a laugh, and the next morning she remarked that she perceived she had used a wrong expression, and, having looked at the dictionary, found she ought to have said *exuberant*.

It is impossible to believe that the foolish things taught to poor girls could long co-exist with a good drilling in scrubbing, scouring, and cooking. This would soon take the nonsense out of school instruction, and education would no longer have the unjust odium of putting peacock's feathers on the daw's back, and spoiling her for what nature designed her. Milliners and ladies' maids require another order of instruction, but they will always constitute a very small fraction of the whole number of working-class girls.

The shorter period that the child is kept in school, when he is industrially trained part of the day, is a great improvement on the old system, and is of great benefit to his mental acquirements. There is no worse mistake than the number of hours which a child is usually kept over books. It destroys the spring of intellectual vigour, and infallibly deadens his appetite for knowledge, even where it does not render its acquirement permanently distasteful to him.

The theory of industrial schools is by no means a new one, either here or abroad, though Holland, Belgium, Switzerland, and some parts of Germany had much the priority to us in applying it in practice; and they are now giving it considerable extension, as Monsieur Ducpetiaux has shown in his elaborate report on farm schools to the Belgian government, rendered familiar to most of us by the late Mr. Fletcher's excellent synopsis of that report.

In England I believe the earliest systematic adoption of farm schools was in the benevolent experiment of Mrs. Davies Gilbert, who, in or about 1842, allotted five acres each to two schoolmasters in Surrey. Their plan was to instruct about twenty-five boys each, during the whole morning, in elementary knowledge, who paid one penny per week, only on condition that they assisted their master in cultivating the land in the afternoon. The low school-fee seems to have been the only recompense for their labour; nevertheless, it answered completely. A very useful little hand-book has been published, entitled "Field Gar-

dening,"* which gives a journal of the operations in these pieces of ground during a whole year, and the work accomplished is certainly very great.

The impulse to the more recent experiments of industrial schools was given chiefly by the reports of the Union School Inspectors in the minutes of the Committee of Council, and who have especially applied their powers to the encouragement of this kind of education, as being in their judgment essential to the counteraction of the pauper habit of mind and body. The results appear to have been entirely in accordance with the views I have had the honour of stating to you. The profits of the system (as tried in workhouses) are considerable in amount, though secondary in principle—the sole object being reformation and the creation of habits of industry. In the reports printed in the Minutes of Council, several accounts and balance sheets of these farm gardens are given. As a useful proof how little school managers need fear the expense of such additions to their establishments, I may cite the following instances of the actual expenses and receipts in some of the West-of-England unions:—

Union.	Acres Cultivated.	Boys Employed.	Total Outlay.	Total Income.	Profit per Acre.
Atcham	2 0 0	14	36 16 0	86 10 2	24 17 1
Church Stretton .	2 0 0	4 & 2 men	17 3 0	43 9 8	13 3 4
Haverfordwest ..	2 0 0	12	3 13 3	21 2 8	8 14 8
Northleach	1 0 0	7	23 13 0	33 14 6	10 1 6
Oswestry	3 0 30	11	26 8 11	69 1 2	14 4 0
S.E. Salop District (Quat) .	11 1 0	24 & 1 man	168 5 11½	328 6 8	14 10 0
St. Asaph	1 1 0	19	2 4 1	20 8 8¾	14 11 8
Wellington, Salop	6 2 0	20	41 17 5½	87 9 8½	7 0 4

The great discrepancy between the sums expended results from the very different modes of cropping the land, and especially of stocking it. The largest profits seem to have arisen where cows and pigs are kept, and where grain crops are *not* grown. In each case spade husbandry has been exclusively

* Published by Simpkin and Marshall, 1846.

used. The expenses include rent, tithes, and rates. Labour is, of course, not included, as it is not paid for; it is that of the boys, who would otherwise be idle.

I must not omit to name briefly one of the great virtues of industrial training in its power in reforming criminal children. This is admirably illustrated at Parkhurst, where the industrial system is more fully carried out than at any other place I have visited, and with great benefit.

The Philanthropic Farm School at Redhill, is specially reported on by Mr. Tuffnell, and the moral advantages of the system and its reformatory effect, are highly spoken of. "The school teachers," he says, "are all industrial and moral rather than intellectual superintendents; and their time is chiefly engaged, not in giving literary information, but in managing the tempers, reforming the habits, and generally regulating the dispositions and behaviour of those who are placed under them—in other words, their duty is to impart education in its highest sense; and on this dependence is, as it appears to me, very properly placed for attaining the object of the society—the reformation of juvenile offenders.

The unvarnished and convincing report recently published by Mr. Barwick Baker, of Hardwick Court, near Gloucester, on his reformatory school on his own estate, is already made fully known to the public through the *Times* newspaper. It is not only important, as showing how successful is this kind of discipline for the reformation of the most hardened and least hopeless boys, but it also shows how well the work may be done at a comparatively trifling cost—the total expenditure amounting only to 11*l.* per head. That such seventeen boys should have so completely cultivated five acres of stiff clay land, that more will be required to keep them employed, is a great achievement in spade husbandry, and proves how thoroughly spade husbandry, boy labour, and reformation suit each other. Another instance is afforded by the success of the Gloucester Ragged School, which pays 25*l.* rent for seven acres, and yields a profit of 35*l.* towards the working boys' dinners.

I cannot admit that the system I recommend, of a devotion of part of the day to industrial instead of school teaching, is the least hardship to the teacher. It is, where too much is not laid upon him, a welcome and healthy relief to the unwholesome monotony and confinement of school work. As regards gardening, I advise schoolmasters to take a hint from the students of Kneller Hall, which is turning out some masters, who, I believe, are second in attainments to no in-door teacher in London, and who think it no degradation or grievance to take off their

coats and work hard at the spade with their pupils, as they are trained to do in that excellent institution.

In conclusion, permit me to remind you that we have fallen on intensely practical times, in which utility is daily becoming more and more the measure of value. Our social fabric is undergoing great change. Year by year less is thought of the beauty of the acanthus, or the symmetry of the volute, and more and more of the solidity of the base, and the adaptation of the column to the edifice it supports. In like manner will education be valued, by the precise degree in which it fits the masses of our children for their obvious destiny in industrial England.

The practical conclusions in which the experience of the past results, seem to be these :—

To render an industrial school useful and prosperous,—

1. The employment must be adapted to the probable future occupations of the children. This for boys will generally be spade husbandry, and the care of pigs or cows, or both; for girls, needle-work, household work, plain cooking, and, where practicable, washing, ironing, and dairy work.

2. The children or their parents must, as an indispensable condition, have some share of the profits of their labour, either in food, clothing, or money.

3. The system must consist of *instructional* industry, not of mere labour.

4. It should be so superintended and tempered as to render it a means of practical moral training.

Under these conditions, I have sanguine hopes not only that experiments made will individually answer, but that gradually, that hearty, earnest and practical character will be given to education, which the country loudly and justly demands for its people at the hands of their educators.

ON THE DIGESTION OF KNOWLEDGE.

By the Rev. C. Marriott, *Dean of Oriel College, Oxford.*

When I first saw the list of subjects proposed for these lectures, I felt that I was not sufficiently master of any one branch of knowledge to undertake even to amuse an intellectual audience for an hour. But when a friend pressed me to offer my services, such as they are, to this institution, it occurred to me that there was one point at least to which my attention had been much directed by late events, as well as by long experience in learning and in teaching, and about which I might be able to throw out a few hints such as might be useful to some learners, and possibly even to a few teachers, although I could but treat even that point systematically. I mean, what I have ventured to call the digestion of knowledge, although I may perhaps sometimes digress a little into the preliminary process of mastication. The present age is, doubtless, unequalled in its advantages for acquiring the knowledge of facts. The atmosphere itself is full of them, they lie all round us as thick as advertisements. It is well if we do not even come to loathe the food we have desired, for its very abundance is oppressive. And much improvement has also been made in the methods of communicating knowledge, by lessons on objects, analysis of principles, drawings, diagrams, tables, and innumerable mechanical helps. Nothing, however, can supply the place of a certain quiet and continued exercise of the mind, by which it becomes familiar with a subject, and gradually assimilates to itself what it has acquired from without.

Of course there is great difference in this respect between different minds. One is able to amass knowledge to a considerable amount, but cannot use or apply it, or can only do so in a very mechanical way; another may, perhaps, have less power of acquisition, but knows what it knows in a living and self-adaptive manner. Another, again, is unable to receive much, because

what is offered to it is not understood, and appears in the form of mere external material instead of vital food. Sometimes a little diversion of the mind into the line of tracing and applying principles would wonderfully facilitate the acquisition of particular information.

To take one of the studies which usually occupy much of our children and youth—arithmetic—it is often forgotten how much may be done, independently of slates and classes, by a little mental exercise on the very simplest and easiest examples. The rules of vulgar fractions are often a long and serious puzzle to the learners, and, what is worse, are often forgotten after they have been learned, for want of any complete realization of their meaning. This is best obtained by operating mentally on the smallest numbers that will exemplify each particular rule, so that the truth of the answer may be easily made evident, and that the reason of it may appear. Adding $\frac{1}{3}$ to $\frac{1}{2}$, subtracting $\frac{1}{2}$ from $\frac{2}{3}$, dividing $\frac{2}{3}$ by $\frac{1}{2}$, or multiplying $\frac{2}{3}$ by $\frac{3}{4}$, are operations easily performed in the head and easily analysed, so as to exhibit clearly the truth of the results. And by ruminating on a few such instances, a mind of ordinary capacity will soon learn the meaning of multiplication and division by fractions, which confuse almost every learner at the first attempt to comprehend them. Fractions are also very well represented by taking a square for unity, and dividing it by parallel lines into as many equal portions as are indicated by the numerators. Two fractions may thus be represented at once in the same square unit by making the divisions cross one another. The effect of this is at once to reduce the two fractions to a common denominator, the product of their denominators. The new numerators may be seen by counting the small divisions, and the rule for finding them appears at sight.*

Perhaps, with a view to mere mechanical accuracy and facility, it may be well to view each rule of arithmetic as a mere rule, and attain perfection by practice. It is well known that in making tables the work is best done by persons who know little beyond addition and substraction, which they perform as directed. But if knowledge is to be fruitful and capable of adaptation to all purposes, it must be turned over and over in the mind, and viewed in all directions. When this has been done with respect to any arithmetical process, the rule can be found again by thinking, even if it should have slipped from the memory.

To take, for instance, the rule for the extraction of the square root. This is often taught without any explanation given to the learner of the reasons for the several operations. But it

* Diagrams were, of course, used in the lecture.

could be easily analysed in such a way as to show plainly why the figures of the root are doubled for the division. This is, of course, most neatly and generally shown by algebra, but may be so clearly exhibited in an example as to be understood by an ordinary learner. It is readily seen that tens multiplied by tens make hundreds, without otherwise altering the figures produced by multiplying the same numbers of units by units, making units. We will suppose, now, that we require the square root of 529. It is plain at once that it must be between 20 and 30, since the square of 20 is 400, and of 30, 900. Two in the tens' place is the root of four in the hundreds', and the next square number is 9; so that the root can have no more tens. To find the units, consider that in squaring the tens and units will be multiplied by the same tens and units. We have then, first, multiplying the tens by tens, (2) tens × (2) tens = 400, then tens × units (sought) = so many tens.

Then multiplying by the units—

units × tens = so many tens,
units × units = so many units.

Thus tens × units appears twice, and is therefore doubled, while units × units appears but once in the product. We have, therefore, in the number 529, first 400, the square of the tens; then *twice* the tens multiplied by the units, or new figure required; then the new figure multiplied by itself. Therefore, subtracting 400, of which the root, 20, is found, there remains 129, which is composed of twice the tens, *i.e.*, twice 20, multiplied by the new figure required, and that new figure multiplied by itself. To find this divide by twice 20, or 40, remembering that the new figure, multiplied by itself, is to be allowed for. On trial we get 3 for the quotient, making the trial-root 20 and 3, or 23. Multiply this by itself—

$$\begin{array}{rl} 20 \times 20 = & 400 \\ 20 \times 3 = & 60 \\ 3 \times 20 = & 60 \\ 3 \times 3 = & 9 \\ \hline & 529 \end{array}$$

Had our number been 528, we could not have proceeded thus beyond 22, the square root of 484, and must have had recourse to fractions for a nearer approximation, but the principle would be exactly the same.*

* Details, which are more conveniently exhibited to the eye, are better omitted in printing; but it may be worth while to refer to the easy geometrical method of exhibiting the square of the sum of two numbers supplied by the second book of Euclid, and to the rule for the square root in geometry, which is given in its final proposition, as capable of being understood by many learners.

I believe this is more usually explained now than it was thirty years ago, when I learned such things. But I mention it not only with a view to the instance itself, but as an illustration of a general principle in teaching and learning. Many a learner would be saved much needless perplexity by a little help toward seeing the plainness of what at first sight looks intricate.

There is great benefit also in familiarising the mind with easy head-calculations, whether in measures, weights, &c., or in any new subject involving numbers, to which the attention is directed. Many parts of the science of mechanics, especially, would be rendered very much easier by this practice. The motion of projectiles, for instance, in its simpler cases, might be made intelligible, and to a great extent calculable, for persons who could give a little of this kind of attention. But even without approaching science, there is abundant room for improving our usual practice in this respect, as may easily be seen by observing how few persons have any notion of applying the commonest measures to common objects. Most persons have learned that an acre is so many roods, but few take the trouble to look at a real acre, and measure it this way and that. It is the same with the measures of distance on a map, which few persons realise so as to have a clear conception of them, except when they are actually travelling. The use of maps in travelling is a great help to their intelligent use in the study of history, and those who stay at home may gain something of the same advantage by the study and the drawing of plans and maps of their own neighbourhood. If I may judge at all, by my own first impressions on the sight of the Rhine, it is worth some little trouble to realise, as far as possible, the appearance of a great river. Those who do not travel, may do it in a manner by laying out measures on the ground, by comparison with rivers, pools, and creeks that they know, and by the use of prints and drawings. I do not mean that all these put together can give the feeling of the majestic flow of a mighty river, but they may serve at least to give a meaning in the mind to the name.

The use of the globes is, perhaps, the best instance in ordinary practice of the kind of study that I have been recommending.† But this is rendered much more serviceable, if combined with a little actual observation of the starry heavens. A night on the top of a coach, or the deck of a steamer, has often taught more astronomy than many book-lessons, or even than lectures illustrated by the best drawings and orreries. I do not mean to

† Perspective is another, if it is followed out with thought. I had intended also to refer to the only lecture I had the pleasure of hearing at St. Martin's Hall, one by Herr Hoffman, on the Educational Use of Toys, as affording an admirable instance of a plan calculated to promote the digestion of certain elements of knowledge.

disparage drawings and models, but they should not entirely take the place of real objects, when those objects can be seen. And a half-revolution of the actual heavens, traced by the eye, is to the orrery, or the globes, what a first journey is to the map. I do not know how it is with others, but to myself certainly the *sun's place in the heavens* was for a long time a very difficult thing to comprehend. The diurnal revolution is more easily apprehended by a child than the sidereal. He thinks the stars change their time with respect to the sun, not the sun with respect to the stars.

In fact an effort of the mind is requisite, beyond what was needed in the old Ptolemaic astronomy, in which the basis of all the celestial motions was the rapid and constant whirl of the mighty sphere of the fixed stars; the annual retrograde motion of the sun, and the monthly retrograde circuit of the moon, being simply conceived as defects of velocity, those lower orbs not attaining to the extreme swiftness of the empyreal sphere.

To those who are not familiar with the subject, it may be worth while to mention that the celestial motions in general are from right to left, as we look to the south. The earth's rotation being in this direction, the apparent diurnal motion of the heavens is from left to right. The real planetary motions being slower, and in the same direction with the earth's rotation, appear retrograde, and are naturally conceived of as deductions from the primary diurnal movement.

Perhaps it is worth while to produce here a little model, which I had made some years ago, to illustrate the principle of the common sun-dial. Every one who has looked at such a dial, will have noticed that it is not divided equally like a clock-face, but that the divisions on the north side, near the hour of noon, are very short. This, of course, is done by rule, and according to a strict rule of calculation, which I wished to see clearly myself, and to exhibit it clearly to others. What I have to say is no news to any astronomer, but I believe many people who take some little interest in astronomy have never looked into it with sufficient accuracy to have a clear notion of the point in question. The model is a sphere, perforated from pole to pole, and with the meridians for the twenty-four hours cut in the surface, divided by a plane parallel to the horizon. The meridians mark the divisions for the hours on the edge of the section. Cutting an orange through obliquely, will show the same thing, in a rough way.

The gnomon of the dial, which casts the shadow, is parallel to the earth's axis. Then taking the plane of the dial as representing a section through the earth's centre, it is clear that the shadow of the axis would coincide hourly with the meridian plane of a fresh hour. And wherever these meridian planes cut

the plane of the section, will be the marks for the hours on the dial. It is thus evident that they are not affected by the time of the year, so far as concerns the sun's distance from the equator, but hold good for summer and winter.

Now I have had little opportunity of studying in the best school for exemplifying the principles of which I am speaking, the practical instruction of very young persons. And I have no doubt but that many persons here present, are before me in all the details of the application of these principles. All I can hope for is to make some impression on a few chance hearers, who may not yet have given attention to the subject; and perhaps to excite in a few *young* minds an appetite for the thorough understanding of the elements of all that they learn. No doubt the youthful mind will sometimes ask irrelevant questions, but it must not altogether be discouraged in questioning. Wait patiently for the answer, is a good rule; but it must be taken in such a sense as not to imply that no answer is to come. The answer may be that the question was wrongly put. "What makes the sun go round?" is a natural question; but the true question, which can be satisfactorily answered, is, "What makes the sun *seem* to go round?" "What makes the apple fall from the tree?" is a question well known to have been asked of himself by the young Newton. The data were so simple that the question was in this case put rightly, and one more question, occurring to the same mind, pointed the way to the greatest of all discoveries in physical science—the key to the mechanical system of the universe. "Why does the apple fall from the tree?" and "Why does not the moon fall to the earth?" were two questions meeting in one point, and thus calculated to elicit an important truth. And the mind which kept those questions in view until it had obtained a thoroughly satisfactory answer, was the mind that could throw light on the whole field of science.

It is worth mentioning, however, that the same questions had been asked before, and the same answer, in principle, had been given to them, but it had not been followed out with the exactness of calculation, and therefore stood as a mere conjecture, instead of a demonstrated truth. Plutarch, in his treatise on "The Man in the Moon" (he does not attempt to write his life, but only to account for his curious face), says that the moon, like other bodies, gravitates towards the earth, but is kept from falling to it by its motion, which creates a centrifugal force, as when you whirl round a stone tied by a string.* The attraction of the earth, also, keeps it from flying off, as the stone would do if

* (De Facie in orbe Lunæ.)—He says, in the same treatise, that Cleanthes of Samos was thought guilty of impiety for teaching that the heavens stand still and the earth moves in the ecliptic, while it also revolves on its own axis.

the string were let go. But this suggestion remained in the pages of Plutarch dead and unfruitful, because it was not carried out into calculation. I cannot take you through the whole of Newton's calculation, for one part of it requires the knowledge of conic sections—that is, of the geometry of those curves which are formed when a plane surface cuts a cone. One of these is the ellipse or oval, which is the curve traced by the moon in going round the earth, and by the earth and each of the planets in going round the sun. Kepler and Copernicus had observed that such was the motion of the planets, and now Newton had to explain the law of it.

Now I cannot make clear to those who are not acquainted with mathematics the proof that the law will be exactly as he showed it to be, though I can show to any tolerably intelligent person the principle on which he proceeded. He calculated, I say, that the motion of the moon and planets must be in ellipses, if they were held in their orbits by a force of gravity varying inversely as the square of the distance—that is, uniform for the same distance, four times less for double the distance, nine times less for triple the distance. It remained to be considered whether the force actually holding the moon in her orbit was in that proportion to the force of gravity at the earth's surface. I will go through the calculation roughly. It is not difficult, owing to certain numbers falling in very conveniently.

[Some preliminary explanations are here omitted, which were briefly given *viva voce*, and are found in all books on the subject nearly in the same form.] The main calculation is as follows:—The moon is distant from the earth about sixty semidiameters of the earth, or 240,000 miles. Hence, as the force of gravity diminishes as the square of the distance, it will be 3,600 times less than it is at the earth's surface. And the moon, in the course of a minute, would fall toward the earth 3,600 times as far as in a second, because the space traversed by falling bodies increases as the square of the time. Hence the moon, if acted on by gravity, and her own centrifugal force alone, would fall toward the earth from the straight line of her motion, as it would be without gravity, as far in a minute as a stone here falls in a second, that is, sixteen feet and a fraction. We may, for this purpose, at present, suppose the orbit a circle at the mean distance. Now, by Euc. III., if a straight line touching a circle, meets a straight line cutting the same circle, the square of the touching line is equal to the rectangle contained by the segments of the cutting line from the point where the two lines meet to the circumference. Thus the deflection of the moon's orbit from its tangent, in a minute, may be very easily calculated. It is necessary to remember that the moon's real orbit is not

twenty-nine or thirty days, but about twenty-seven and a quarter, since the sun describes a twelfth of his apparent orbit while the moon describes hers, and is therefore so much before her, delaying the new moon something over two days. Dividing the whole circumference of the orbit, or about 3¼ times its diameter by 27¼, we have the motion in a day; then dividing by 24×60, we have that in a minute; squaring this, and dividing by the diameter of the orbit, we have the deflection from the tangent, which is sixteen feet and a fraction, as ought to be the case.

It is one use of this kind of rough calculation, which I have before recommended, to give the mind a command of figures and a knowledge of their value. It is sometimes said that you can prove *anything* with figures, and so you can, if people will let you. But people who have been used to handle figures, and apply them to all manner of subjects, know what figures are worth. And a very moderate degree of such practice will often enable you to detect inaccuracies and inconsistencies in statements which might otherwise be incautiously received. I will give two *extreme* instances, from which you may judge how far mis-statement is sometimes carried.

I have seen in a newspaper that the amount of rain which fell in Edinburgh, in a certain year, was equivalent to 833 times the pressure of the atmosphere.

Now, the pressure of the atmosphere is equivalent to thirty-three feet of water on the same surface, consequently, the quantity of water which had fallen, had it remained where it fell, would have stood 33×833 feet deep on the ground, giving an average of somewhat more than seventy feet per day, that is, about twenty-four times as much every day as actually falls in a whole year. This statement was accompanied with one of the number of hogsheads per acre, which was very far nearer the truth, and the comparison made by reducing them to a common standard at once showed the ignorance of the compiler. In another case, I have known three places of decimals read into a number so as to mislead the hearer entirely, if he did not calculate in his own mind the improbability of the statement being true. I will give you another instance for which any astronomer present will quiz me; my excuse must be that I am generally busy with other things, and have forgotten some parts of my astronomy. When I began to make the calculation I have just shown you about the moon I could not get it right. I will not tell you all my mistakes, because I have forgotten some of them, and some of them were too bad. But after I had corrected some obvious errors, I still could not make it come out right; and as the only quantity I doubted about was the distance the moon moved in a minute, I looked into a book of astronomy, where I saw, to my confusion, that I

had reckoned the time of the moon's orbit at 29 or 30 days, instead of 27⅓. I have already explained the reason of this correction. I had forgotten this point, and the rough calculation of the force of gravity came near enough to detect the error, and compel me to correct it. Such cases show the advantages of comparing different statements, reducing them to a common standard, and otherwise working out numerically all points in which numbers are concerned, for the purpose of detecting oversights in your own view of a case, and completing your knowledge and understanding of it.

We see, in such a case as this, an instance of the digestion of knowledge by the species as well as by the individual. Newton used the facts and calculations of Kepler and Copernicus, and they used the observations of their predecessors. But the actual combining process, which brings out great and new results, takes place only in great minds. Still an ordinary mind has within itself a similar power, and cannot be truly educated without some development of that power in those easier instances which occur in all serious thought and study.

But digestion does not belong to figures only. It has place in moral and practical knowledge of every kind, and even in such knowledge as is in a great degree above our understanding. In history, it is of the greatest importance, and may be obtained by dwelling on particular periods or courses of events, with some attention to collateral illustrations from geography, biography, antiquities, and contemporary works of literature and art. Even fiction, judiciously employed, may render important service in giving young minds an interest in historical periods, and aiding older readers in forming a lively impression of events, characters, and customs.

I believe this is often done in too ambitious a manner, with too much effort to make at once a set of young philosophers. This should not be the object so much as to familiarise the mind with a few of the certain facts and real characters of history, in their relation either to eternal moral truths or to the progressive history of mankind. The combined history of Christianity, civilization, literature, science, and constitutional government, is a living history, and interesting to every intelligent mind the moment that its relations are apprehended. The mere narrative of territorial conquest, or the contests of rival parties, is lifeless as a whole, though it may comprehend incidents of overpowering interest. Battles are grand things, but what are they fought for? We cannot make young people understand *all* these matters, but they may learn from the first to fix their attention on great principles and great men. They will perhaps most easily discern principles first in the aims of some great man, and may be led

to exercise their minds in thinking why did he do this and that? How did he succeed? Has the same object been attained since his time? What effect had his efforts in bringing this about? What had he to do? What difficulties to overcome? Where did he learn to strive for good beyond his age? What was the influence of his work in after ages? Or again, if his views were of a more temporary character, why did he seek this object? Were there good men opposed to him? How came it to be so? What result did Providence bring out of their opposition? These are questions beyond the first inquiry of the child, "was he good or naughty?" but they are those into which that inquiry may be turned, by following it out into its several bearings. And it is only by some such process that we can relieve the mind of the disgust which necessarily follows on its disappointment at the untimely fate, the imperfect success, or the clouded character of its heroes. Trace them aright, and we find their work is done. The fairest example we have is in the history of the Old Testament, considered as bearing upon the New. The coming of our Lord, and the foundation of His Church, may be considered as a completion of the previous work, the end towards which it was all directed. Taking this view, we are no longer astounded and baffled by the painful events of the preparatory period. We grieve over the sin of Moses, the error of Gideon, the cruelty and tyranny of Abimelech, the rashness of Jephtha, the weakness of Samson, the degeneracy of the sons of Samuel, the fall of David, the idolatry of Solomon, the division of the tribes, the eclipse of the kingdom of Judah, but we can trace the quarrying and levelling for the new temple throughout. Whoever has well learned and understood this history as comprehending the education of a nation for the reception of the Gospel, and the placing of that nation in the world so as to convey the leaven of the Gospel to every civilized people, has made such a beginning in the philosophy of history that he will scarcely read without profit whatever records he may take up. We know not toward what consummation we are now tending, but we know enough to be able to discern some lessons that are now in course of teaching to the nations, and to form some notion of the way in which we can contribute toward the learning of them. The principles of peace, unity, forbearance, justice, equal rights, and all reasonable liberty of conscience, of international arbitration, of association amongst individuals and amongst nations for mutual benefit, are evidently working their way among mankind in spite of many hindrances, and every step that has tended to enforce them may be viewed as a step in the education of mankind, and take its place in the biography of the species. The connection of those principles with the working and development of

the church, is like that between the moral and the religious life in each individual; and the steadfast striving of good men from age to age to impart a character of sound religion to the moral, social, and political life of their own countries and of the world, is one of the most interesting and observable facts in all our records. The future of the world may be beyond our guess, but the future of our own country depends much on the energy applied in this our own day to this very object, and that mainly in the work of education. I have seen in this building evidence that we are not wholly asleep, and I trust we shall be more and more awake to the necessity of educating every Englishman, and the *whole* of every Englishman, body, soul, and spirit. We do not want mere manufacturing machines, money-getting machines, talking machines, fighting machines, or preaching machines, but *men*, who love God and their kind, and who will leave the world happy if, so far as their own work is concerned, they leave it better than they found it.

After this rambling, and I fear tedious talk, you will yet excuse my saying a few words on one more subject; one which is of great interest as regards English education, although it is not immediately much connected with the present exhibition, or with the Society of Arts—I mean the educational system of the University of Oxford. I have been long connected with that university, and have often had occasion to remark the misunderstandings which have prevailed with respect to its studies and its education in general.

I have often heard it represented that we limit our views to ancient literature, ancient philosophy, and ancient languages; and are enslaved, in short, to antiquity. We have recently met this accusation by extending our system of university examinations and honours to modern history and the physical sciences in general, and I think we have done well. But our ancient studies remain, and still appear to many a relic of barbarism. Now, I cannot enter at length into the defence of the system—all I wish to do at present is to explain its meaning. It is principally a system of exercise for the mental faculties, but it is also a study of the elementary portions of the science of man. We study the sacred history, which is the spiritual history of mankind, the history of Rome, which gives us the fundamental positions of human law and civil society, and the history of Greece, which gives us the early development of man's intellect and philosophical observation. We study all these, with contemporary literature enough to open to us the very life of the men of whom we read, and who were forming prospectively the elements of the society in which we now live, and of the technical language in which we think. We study also philosophy much more freely

in the works of the ancients, whom we do not fear to criticise, than we could do in the lectures of some modern professor who held the rod of systematised intellect over us, if not that of actual power and castigation. We study language with the advantage of the finest models, and with the most elaborate criticism to aid and test our own researches. We study mathematics and physics well when we study them at all, and I trust I may venture to say, we are advancing in those studies, and in the provision of means and appliances for them.

But when I hear some people propose that we should shorten our vacations, in order that our young men may learn more in the course of the year, I confess I cannot agree with them. I have been endeavouring to show, in some little degree, that it is useful to digest what we have learned, and not merely to go on cramming fact after fact into our aching heads. And time for thought, for growth of mind, for the application and incorporation of knowledge, is as necessary as time for acquiring information.

If I may be pardoned for following the subject one step farther, I would say a word on the measure which has just passed the legislature, and which is supposed by many to be a rude shock to certain antiquated prejudices that haunt the old quadrangles of our university. I will venture to say, in the name of Oxford in general, that the feeling supposed by its enemies, of a wish to keep down dissenters, by excluding them from the benefits of our education, does not exist. But it has been, and is, the feeling of the university in general, that an educating body at this time of day ought to know what religious truth is, and to teach it as truth; and that if it is not taught as truth, the young mind is misled into supposing many things uncertain which are certain. Now, given the Bible, in its true meaning, as authoritative in doctrine, with the principles and helps of interpretation generally recognised among Christians, the religion we have taught hitherto in Oxford, in its essential features, is not a matter of question, but of certainty. There *are* open questions, but there is a body of divinity which does not admit of any doubt, except from ignorance, or the partial negation of principles assumed as fundamental by the Church of England, and by every sound Christian mind. When we cease to teach this as of authority we shall be bewildering, instead of educating our youth, and I trust the day may never come. What has passed the legislature does not of itself place us in such a position, and we may cheerfully proceed to receive all who can appreciate our education as it is, whether they may scruple to subscribe some of the 400 and odd positions said to be contained in the Thirty-nine Articles or not. All we wish is, that we may not be com-

pelled to divest the truth of its vitality before we present it for their acceptance, and to say of everything, however sacred, that it is merely what some people have thought and written. Let those who know the importance of dealing in this way or that with the most vital truths of Christianity, beware how they sanction any attempt to deprive us of the liberty of teaching religious truth as truth, to be the food of the soul, and not merely the distant object of the intellect. For the day we lose that liberty, England, as a nation, loses her religious life. What we have we grudge to no man, but we do earnestly deprecate any such course as would destroy the very benefits which it is meant to communicate.

ON ECONOMIC SCIENCE.

By WILLIAM ELLIS, OF CAMBERWELL.

AMONG the great events of the age in which we live, although many are more striking, few perhaps have been more fraught with benefit to mankind than the altered state of public opinion in regard to the principles of Economic Science.

Having learned to read the recommendations of this science, and to respect the laws comprised within it—a disregard of which is ever privation, and not unfrequently severe suffering, in our own country at all events—man in his legislative capacity has emancipated industry from most of its shackles, has purged his system of taxation from the waste and annoyance of differential duties, has turned colonial intercourse into an interchange of benefits, instead of mutual detriment under restrictions, has given a free scope to commercial transactions, and has abandoned usury laws, and other attempts to prevent the flow of capital to those agents by whom it is most likely to be turned to account in producing an abundance of the necessaries and comforts of life, for the benefit of society at large.

The works just mentioned are what, as you all know, we have performed of late years in this country—what we have done *legislatively*. The works which I am now about to mention, are what we are going to perform—or rather what we have already begun to do *educationally*. For we are at last happily arriving at the conviction, that great as may be the blessings secured by regulating our public acts in accordance with the principles of economic science, they are as nothing compared with the blessings in store for us when we shall have succeeded in regulating our private conduct in accordance with those same principles.

It is of man's conduct, so far only as it bears upon his command over the necessaries and comforts of life, that economic

science treats *directly*, although it may be said to treat *indirectly* of man's conduct in general—for an abundance of the necessaries and comforts of life is indispensable to the prevalence of good conduct. Few who have thought much of man's nature, his wants and propensities, and the temptations to which he is exposed, will be disposed to question the correctness of this statement, with which, also, all our statistics are in perfect keeping. The conduct, besides, which is recommended by economic science as a means of procuring abundance of the necessaries and comforts of life, is the very same as that which is recommended by the moralist who contemplates man from a more comprehensive point of view. He will, of course, combine with those rules of conduct other rules not strictly deducible from economic science, aiming at wider purposes, and enforced by different sanctions.

A simple enumeration of some of the more obvious deductions from the principles of economic science will suffice to rivet the attention of every intelligent educator. To enjoy abundance of the necessaries and comforts of life, men must work assiduously, intelligently, and skilfully; they must make provision out of present earnings for future wants; they must respect property, and they must perform engagements with fidelity. Differently expressed, abundance of the necessaries and comforts of life will be enjoyed by mankind in proportion to the prevalence of industry, knowledge, skill, economy, respect of property, integrity, punctuality and sobriety. But the dependence of abundant supplies of the necessaries and comforts of life upon a prevalence of these qualities, is not more certain than is the dependence of a prevalence of these same qualities upon the care with which knowledge is imparted to, and habits and character are fostered in childhood and youth, upon the care with which all the young are made to come under the influence of good teaching and training. Nothing, then, can well be more simple than what economic science enjoins to educators, or to those who set education in movement. Perform these duties towards the young, and abundance will cover the earth. Neglect them, and scarcity and destitution will afflict society. Perform these duties, and labour will have sufficient wages, capitalists remunerative profits, and landlords appropriate rents—each industrial class and subdivision of classes achieving comfort for itself, while it promotes the general well-being. Neglect these duties, and wages, profits and rents will be insufficient; and all classes, while dissatisfied with their respective shares, will be looking to what others possess, as the cause of their own privations.

A survey of society, even in our own age and country, with all its comparative advantages and its recent improvements, dis-

closes to us much of want and suffering considered by almost universal consent as susceptible of mitigation and diminution in the future. And here it is that I would earnestly invite the educator's attention to the different means resorted to for the purpose of circumscribing human suffering by those who reject and those who accept the instructions of economic science. The mention of a few of them will serve the purpose of illustrating the truth or of exposing the fallacy of what has been claimed on behalf of economic science, and of concentrating the remarks with which I hope to be favoured upon definite subjects peculiarly adapted to test the soundness of economic principles, by the success or want of success in our attempts to give them a practical application.

Let us begin with the notoriously insufficient wages of large numbers of labourers in various departments of industry. No subject has more deservedly attracted the attention of philanthropists.

Widely different are the causes to which these insufficient wages have been attributed, no less so the proposals that have been offered, and the attempts that have been made in order to raise them. By scorners of economic science, insufficient wages have been attributed to the grinding of farmers, of manufacturers, and of other employers of labour, to the introduction of machinery, to exorbitant rents, incapacitating employers from paying what they could wish, and to foreign competition. In harmony with these views, the means suggested to increase wages have been to form combinations of workmen, to discourage and obstruct the introduction of machinery, to remonstrate with masters, nay, to denounce them as a species of unfeeling monsters, to vituperate landlords, and as far as possible to compel them to abate a portion of the rents to which they are entitled from their tenants, and to impose restrictions upon foreign commerce.

The student of economic science has not failed to dwell long and painfully upon that most sad and yet interesting social phenomenon, an insufficient rate of wages, nor has he slightingly passed by unexamined the various means thus confidently recommended to abate an evil, the consequences of which must be misery in one or more of its many shapes. Having examined these means, he has convinced himself not only of their inadequacy to accomplish what is proposed to correct the evil, but even that their operation must be to act rather as aggravants than as mitigants. More than this, rising from the negative to the positive, he has pointed out that insufficient wages, whether prevailing generally or locally, may ever be traced to errors of conduct in the labourers themselves, originating sometimes in ignorance, sometimes in defective habits, and more frequently in

the two combined, and that consequently no improvement of wages can be reasonably expected from any efforts which do not aim at operating an improvement in conduct. If the economist be justified in this conclusion, he must necessarily appeal to the educator for his assistance, since how is improved adult conduct to be expected, when childhood and youth feel the want of that teaching and training essential to the right conduct of maturer years?

Turning next to those social disorders which make themselves felt through farmers, manufacturers, merchants, and employers and directors of labour in general, such as bankruptcies, commercial panics, and a wide-spread suspension of works, they have been attributed to want of money, or to some inexplicable agency, whose spasmodic attacks, beyond the power of man to avert, demand the interposition of some supernatural government or bank to mitigate. Hence the call for inconvertible paper and for loans on indifferent securities to the prejudice of the lenders, whether the government, as representing the whole nation, or some individual or combination of individuals, and to all who would borrow on good security. The economist has had occasion, in common with others, to deplore these industrial calamities, to investigate the causes of them, and to search for antidotes of these causes. He has convinced himself that the fearful calamities under consideration are effects of very different causes, and that the measures proposed would rather extend than diminish the disorder for which they were meant to be remedial. He has gone further, he has traced suspensions of payment and bankruptcies to the misuse of credit,—itself a consequence of ignorance or of bad habits, or of the two combined. He has thus again pointed to a remedy specially demanding the educator's co-operation, which, if slow, cannot fail to reach the seat of the disorder, better teaching to supply the knowledge how to use credit, and better training to form the habits through which the knowledge must be applied.

One more economic problem, and I have done; one other case for the social pathologist, if I may so express myself, its diagnosis and its treatment, first by those to whom economic science is an unknown quantity, and secondly by those to whom economic science is as a light guiding benevolence to accomplish its purpose. I need scarcely say that I refer to that want of means bordering upon absolute destitution which we everywhere see more or less around us. Its contemplation unrelieved is intolerable to all benevolent people, whether they despise or regard the exhortations of the economist. Their action is to relieve the destitute. Some organise societies for the gratuitous distribution of bread and coals, and for exploring the holes and corners in which

misery tries to hide itself. Others open and maintain soup kitchens and shelter for the houseless. But the votary of economic science, who acts up to the precepts which he has gathered from his studies, is not content to rest here. His eyes having been opened to the causes that have led to the destitution which he is called upon to relieve, he cannot, he dare not, connive at their being allowed to work unheeded and unopposed, to produce a never-ceasing supply of miserable objects in the future. While stretching out the hand of charity, the opportunity is presented to him of verifying in detail the soundness of those economic principles by which he feels he ought to guide his conduct. As the objects come before him to receive the inadequate pittance which alone charity is capable of doling out, he finds few, the history of whose previous lives he is able to investigate, that he must not enumerate as the victims of ignorance, of idleness, of wastefulness, of drunkenness, of dishonesty, or of all combined; the victims, in short, of that want of good teaching and training in which social defects take their rise. And here may be noticed one of the many unjust charges which have been brought against the votaries of economic science, who are not, any more than the votaries of other sciences, to be made collectively answerable for every crude and rash expression uttered in their name. They have been represented as averse to the relief of the destitute, and as discouraging the charities of life. Such charges are utterly undeserved, as applied to the true and faithful interpreters of the science. They do, it must be admitted, try to keep within bounds any feelings of exultation or of self-satisfaction that may be awakened in the charitable, by the joyful tears and grateful thanks of the objects of their charity. "Hold," say they; "you have but begun—you have not yet completed your work. The larger call upon your exertions remains to be made. You have to prevent future, as well as to relieve present destitution." The individual who, while he neglects the first and greater duty, performs the second and lesser, escapes any severity of comment, because we are too glad to welcome everybody who contributes his mite towards mitigating human suffering. But individuals in the aggregate, or society, who allow the causes of misery to flourish unheeded, let them be as active as they may be in dealing with effects, must be condemned as tainted with one, at least, of two very serious defects—want of intelligence, or want of benevolence.

In the present lack of agents thoroughly qualified to participate in the great work before us, that is, of qualified educational agents, it must be confessed that the prevention of destitution is something remote—its diminution to be expected only by slow degrees. But there is this remarkable difference between

attempts to relieve destitute individuals, and attempts to prevent destitution. The former, as you look at each separate case, one after the other, seem immediate and effective, and yet collectively and eventually, they are inadequate; while the latter, though apparently distant and uncertain in their operation, collectively and eventually, must be crowned with success. The ignorant are ever more ready to award praise and sympathy to those who deal with *effects*, than to those who attach themselves to *causes*. They applaud the association which gives bread and coals to the indigent, and the dispensary which administers medicine to the victims of typhus and cholera. Knowledge is required to appreciate the efforts of the sanitary physician who keeps away fever, and of the educator who keeps away indigence, by preventing the causes in which they originate.

You will observe that, in my opinion, economic science proffers most valuable assistance to the educator who aspires to make his teaching and training instrumental in preventing or diminishing human suffering. It is the essence of the educator's calling, at all events, to aim at future effects through present work. He does not superintend a refuge for the destitute: he so superintends and directs the children under his care, as to qualify them to keep away destitution from their future manhood. He is neither the surgeon nor the policeman, to watch over the dissolute and the drunken. His high office is to keep away—to exorcise profligacy and drunkenness through the influence of knowledge, example, and habits which, after a time, make vice almost impossible.

I have selected three phases of human misery, which, as it appears to me, the educator is capable of greatly modifying, provided always he have the intelligence to appreciate and the ability to teach those truths and principles embodied in economic science. These three phases are—

1. Insufficient wages.
2. Bankruptcies and industrial convulsions.
3. Destitution.

How far you may coincide in the views which I have thus briefly expressed, and what are the best methods for promoting the instruction and forming the character of the young, so as to arrive at the kind of adult conduct through which alone sufficient wages, industrial peace, and abundance can ever prevail, are the topics which I now venture to submit for your consideration. I need scarcely add that the limited time at our disposal makes it peculiarly desirable that all objections, criticisms, suggestions, questions and answers, should be as much condensed as possible.

SCIENCE IN THE MINES.

By HERBERT MACKWORTH, ESQ., *M. Inst. C.E., Hon. Member of the North of England Institute of Mining Engineers, Government Inspector of Coal Mines.*

THE want of popular information on the subject of mining may cause "science in the mines" to be looked upon by many as involving more difficulties and mysteries than the other subjects to be found in the programme of educational Lectures. By the aid of a little science, however, to explain and to illustrate, these difficulties will disappear; the empiricisms of the practical man will be found to belong to general rules, and the art of mining will be shown, in each step of its development, to be indebted to the labours of men of science. To prove this close relation, it might almost suffice to recall the names of those who have led the way in the improvement of the art—of Smeaton, Watt, Stephenson, Davy, Buddle, Wood, and Taylor, in our own land, and of Werner, Humboldt, and Combes, on the continent. But to convince a miner, than whom no one adheres more stoutly to that much-abused title, "a practical man," of the full scope and power of his auxiliary, a close investigation is necessary.

Experience is the foundation of science and skill. Reasoning on the results of previous labours, in order to overcome a difficulty of a new or a greater kind, is identical with the inductive process of the man of science. If it were possible to find a man in no way indebted to science, even the most rudimentary, such as the practical man assumes himself to be, he could copy or reproduce, but not better than many machines, and would be infinitely surpassed by them in economy and power. The instances are, unfortunately, very numerous, where the practical man affects to despise the experience of other men or of science; he is ignorant, because he restricts himself to his

own limited experience—he occasionally indulges in the wildest speculations, because he will not understand the reason of what he does and sees, and certainly the mistakes which have been committed by the abuse of science are not to be laid in the balance with the enormous sums of money which are day by day squandered in this country by entrusting the charge of works, often involving novelty or improvement, to the hands of ignorant or uneducated men. I am not underrating the value of practice—experiment is the foundation of science, as science is of the advances of practice. There are three ways in which we have drawn from the exhaustless stores of science to supply our wants and enlarge our resources. We have made some progress by those brilliant though rare discoveries, the result, it may be, of accident or imagination, but linked to the useful and the known by the laws of science; still more is due to the application of these laws to correct our judgment or our performances, and to modify or improve our plans; but it is in its third remaining province that science is subservient to mankind at large—it explains, it generalises, it becomes our guide, and spreads among men that knowledge by which the power of the head is added to and skills the hand. Nothing is too simple or too common to be beneath its sphere, from the food we eat to the latest success of agricultural chemistry—from the shaping of a pen to the machine which prints 8,000 copies in an hour; from the excavation of a quarry to the winning of a deep mine; we find on examination that whatever we at present call "perfection," we owe to the labours of applied science. As the mines have been the birth-place of our railways, as well as of the locomotive, and the nursery of the highest engineering talent, it may be supposed with truth, that they present extraordinary difficulties, and that therefore, under the pressure of necessity, they force into activity the highest order of skill for their improvement; in fact, a Newcastle colliery presents the most remarkable illustration which this or any country can boast, of the successful application of science and experiment for several ages to overcome the difficulties of practice. Many mining districts might be mentioned, which are half a century behind the north of England in economical improvements; and as exhibiting the want of information even amongst the managers of mines in these districts, it may almost be taken as a rule, that wherever minerals are abundant, near the surface, and easily accessible, there the most primitive, wasteful, and expensive methods are retained for extracting them. The entire cost of extracting and landing a ton of coal on the surface amounts to 3*s.* 6*d.*, whether it be extracted in Staffordshire from the ten-yard seam, from the Newcastle seams of four to six feet in thickness, or from the thin and perpendicular

seams of Belgium, which average twenty-six inches only in thickness. In South Staffordshire the barriers of coal and the faults have been recklessly driven through, and large areas are consequently drowned out by water; the system of working the coal is so wasteful, that one-half the entire seam is destroyed, and left underground—a seam which contains 40,000 tons of coal per superficial acre, rarely yields 20,000, whereas in the same district collieries have been worked which yielded upwards of 30,000 tons. In other countries, where waste in the most precious of natural resources cannot be afforded, the lessee is compelled to bring out the whole of the coal; and this indeed is the ground and aim of the interference of foreign governments with mining education. The result of the Staffordshire system is a scarcity of minerals now pressing severely on the manufacturers of that district, but it is gratifying to find that the recent labours of the Geological Survey are bringing to light the existence of beds of coal and iron-stone which will happily compensate before ruin has set in for the dearth caused by practical ignorance and error. The introduction of permanent competition in the trade by the opening out of new districts, will tend, as it always does, to the employment of science, and the result may be safely predicted to consist in larger profits to the proprietor, and increased safety to the workmen.

A large mine is a complicated machine. To understand thoroughly its working involves a study of boring, sinking, pumping, winding, hauling, getting, and ventilation. A popular and correct account of the great North of England collieries may be found in Longman's Shilling Series, entitled, "Our Coal and our Coal Pits." A similar work, by the same author, on the Cornish Mines, which are the most important metallic mines, is just issuing from the press.

Some coal mines cover an area of two square miles, containing upwards of 160 miles of galleries, and forty miles of underground railway. The shafts vary from four feet to twenty feet in diameter, and descend to depths of 600 yards in England, as at Monkwearmouth, and to 750 yards below the surface in Belgium. The mouth or eye of the shaft is covered by a lofty pyramid of timber, coal screens, engine-houses, pumping, and winding machinery. A direct acting engine brings two tons of coal to the surface every minute, at a velocity of twenty miles per hour, whilst an underground engine, working an endless rope, draws trains of fifty waggons at a time from the extremity of workings two miles distant from the shaft, at the rate of ten or fifteen miles per hour. Upwards of 1,000 men and fifty horses are employed in driving exploring galleries, in maintaining the roofs, the roads, the ventilation, and regular working of every part, in ex-

tracting the coal, and keeping the trains and engines fully supplied. The largest metallic mines require the labour of 1,200 men, but they are seldom worked by the aid of horses or underground engines. They may contain forty miles of horizontal galleries, and twelve miles of shafts. They extend to depths in Cornwall of 750 yards.

We require the aid of mineralogy and geology to ascertain the nature and value of a mineral, its true position in the earth's crust, its probable abundance in particular strata, and whether in threads, bunches, veins, or beds. On each of these points depends the outlay of capital which it may be necessary or desirable to make. By the same means, we ascertain the best position to sink our shafts, so as to avoid water and faults, and to reach the lowest part of the work, that the excavation may proceed upwards and all water and minerals descend to the shaft.

Without mechanics, it is impossible to select the most economical means and arrangements of transport, either in the mine or in the shaft, and to ascertain the relative economy of engines and other machines, and to place the machinery in such manner and positions as will obtain the greatest amount of useful work with the least expenditure of fuel. Pneumatics are essential to the knowledge of ventilation, on which the amount of manual labour, and the health and safety of the workmen, depends; whilst to chemistry chiefly belongs the analysis and preparation of the ore, and the choice of various processes for extracting metal of the most suitable quality. "Can we hesitate to recommend a course of instruction in these sciences as eminently practical in its nature? Can we have too many facilities for distinguishing the different strata in their mineralogical relations, for ascertaining the direction and contents of the included veins, the nature of their produce, and the most efficient mode of exploring them? The drainage, whether by steam or water power, including the dimensions and placing of the engine, the economy of fuel, the preservation of the boilers, and the arrangement of the pit-work, to be accomplished with certainty must be founded on sound mathematical and mechanical, and, I might add, chemical principles. And when the strength of materials shall have been correctly calculated, and the sinking of shafts in the right places, the blasting, lighting, and ventilation of the mine, and the descent and ascent of the miners perfected, and the ores are at length 'at grass,' can we yet decide on the best mode of dressing them? Can no improvements be made in crushing, stamping, or calcining? Can we, from practice or from any analytical skill at hand, at once determine what ores are sufficiently rich in iron, manganese, silver, arsenic, cobalt, zinc, or sulphur, to warrant our pursuit or selection of them? The best mode of separating

many of those substances, to say nothing of the smelting of our inferior copper ores, is still to be learned. Has not Pattison, by his scientific skill, added more than 20,000*l.* per annum to the value of the lead ores of England, and reduced the expense of extracting the silver by two-thirds? I assert, without fear of contradiction, that however desirable the division of labour, and however conversant the mine agent may be with a few or more of his pursuits, circumstances constantly arise in which his experience alone will not guide him. I gladly admit that many of our engines and mining works, partly the result of the strong necessity and the enormous expenditure, and the scale in which innumerable trials were made, are models for imitation; and that we possess many men of genius and industry who, after having laboriously groped their way for years, have given to their undertakings the touches of a master's hand. But, in the interval, how much has been lost to the country in the relinquishment of deep mines; and if we could analyse the long mental process, it would be seen how largely these men had imbibed from time to time the important truths developed by educated minds of deep thought. It must not be forgotten that this experience has often been obtained at a great expenditure of life, time, and money. If, in the healing art, the uneducated at length attain considerable proficiency, still the veil must be drawn over the death and suffering which marked his progress; so in mining, the apprenticeship has often cost the lords the abandonment of valuable veins, and the adventurers sums varying from 100*l.* to 5,000*l.*, and without the benefit to be derived from communicating generally the causes of failure or ultimate success." How often do we find the expense of boring or sinking shafts incurred before the geological nature of a country is ascertained! Large sums have in this way been squandering in searching for coal. About forty years ago, at Wincanton and Oxford, borings were commenced in the Oxford clay, and continued down to the oolite, the coal measures, if they exist beneath, being probably two-thirds of a mile deeper still. Borings, attended with the same want of success, were undertaken at Chard, in the lias of Somersetshire, without a previous examination of the thirty miles of country intervening between there and the nearest point of the Somersetshire coal-field.

The oversight of the projectors in each of these cases has been in assuming dark clays, or ferruginous waters, or fragments of lignite as indications of coal in rocks, where science has shown that it does not exist; and in failing to examine geologically the dip and thickness of the overlying strata across the terra incognita which separates them from the nearest workings of coal. It were wiser to commence at a shorter distance; and an

ample field for such discovery is open in England, with far more reasonable prospect of success—in Cheshire, Somersetshire, or on the lines of several hundred miles in extent, where the coal measures, resting on the flanks of the central Grit and Limestone chain of England, descend underneath, and are concealed by, the later uncomformable rocks. In these situations the deep-boring systems of Kind and Degousee, practised on the continent, might be applied with success, and bring into the market a vast amount of additional mineral property. Numerous other instances of fruitless adventures for coal are to be found in the millstone grits of Devonshire and Yorkshire, and in the silurian shales of Carmarthen, Merioneth, where a superficial knowledge of geology would have shown that no coal could exist. Notwithstanding the demonstration by William Smith in 1816, of the regular sequence of fossiliferous rocks, there have always been found persons blindly incurring the heaviest penalties, for the want of geological knowledge. The first sinking of the Haswell colliery was abandoned, after an outlay of 60,000*l.* in endeavouring to pass through a bed of quicksand. Geology, in acquainting the proprietors with the nature of the rocks, should have warned them of this, and of the necessity of boring. The present shafts, sunk at a short distance from the first, avoided the quicksand. The Monkwearmouth shaft was nearly abandoned in consequence of an error of 100 yards in the calculation of the depth to be sunk. This was afterwards found to arise from no allowance being made for the denudations of the coal rocks, which are overlaid by the magnesian limestone.

In the absence of an acquaintance with mineralogy, blende has been mistaken for lead ore; and in another instance, large quantities were thrown away, under the name of "spar." An iron master supplied calamine in lieu of iron ore to his blast furnace, until he found out his mistake by its vanishing up the chimney. Many thousands of pounds' worth of the sulphide and black oxide of copper have been thrown into the sea on the shores of Cornwall. On the other hand, the experiments of Professor Plattner, in Silesia, have resulted in the remunerative extraction of one part of gold in 228,000, and in Siberia, with low-priced labour, one part of gold in half a million parts of sand, will pay for separation. As a striking example of the successful application of science and perseverance verifying the predictions of the philosopher, the discovery of gold in Australia is familiar to all. By the kindness of Mr. Hargraves, the distinguished pioneer of the Australian El Dorado, who has honoured me with his presence here this evening, I am able to exhibit some choice nuggets, characteristic of the various localities.

Within the province of mechanics, numberless instances will

occur to every experienced miner of the errors which sacrifice power, or its equivalent, money, and of the fallacy of entrusting any contrivance to an ill-informed man, who must necessarily make a number of costly experiments; and if he should stumble in the dark over a solution to the difficulty, ends at last with a patch-work, defective both in convenience and economy. The most common defects are, employing manual labour instead of horses, or horses in lieu of engine-power, expending labour and blasting, where the pressure of the ground itself could be made to do the work; and turning over the minerals several times during their transit, thereby injuring their value, especially in the case of coal. Although all seams of coal up to three feet in thickness are worked by longwork, in which the pressure of the roof aids in detaching the coal, and the whole of the coal is brought out of the mine, yet, singular to say, seams which exceed this in thickness, are worked on a different system, by which these advantages are lost. The systems of working coal are numerous; and every seam differs from the rest, either in thickness, inclination, quality, fracture, or the nature of the roof and floor, requiring, in every instance, some modification in the working; yet the same systems of work have become established for all seams of every kind, over certain areas of country; which show that they are determined much more by accident and geographical position, than by experience of the different systems in use elsewhere, and skill in selecting the most suitable. The consequences of such deficiencies are serious; not only is much more coal reduced to the state of small coal, and either left in the mine, or reduced in value, but a large proportion of many of the best seams of coal is left underground, and the resources of fuel with which England has been so munificently blessed, are reduced by at least one-third. Surely the question of mining education is one of national importance. Is it to be doubted that if the captains of our metallic mines were better acquainted with mineralogy, that the works would be more judiciously carried on for the discovery of ore; and that valuable ores would seldom be overlooked and irrecoverably lost, as is the case in even the best-conducted mines, and to a greater extent, we must reasonably infer, than in the coal mines? Is it not a reflection on their mechanical skill that the washing and cleaning of mineral ores should be carried on by manual labour in lieu of machinery?

At many mines where a single unbalanced rope is used for winding the produce, the fact is altogether overlooked, that for every ton of mineral raised since the commencement of the works, an equal amount of power has been thrown away, in raising a ton of rope. It is rather a nice calculation to deter-

mine all the conditions for balancing one rope or two ropes in a shaft at every point of their course, and to determine the economical value of wire ropes, which for the same strength are only half the weight of hempen ropes, and are now being much introduced. With the exception of the Cornish pumping engines, and the first motion engines required for fast winding, little attention is paid to the proportion and condition of their working parts. It sufficiently shows how little care is given to small errors in the steam passages, expansion, condenser, or pumps, by which, however, one-half the power may be lost, to mention that the name of Watt's Indicator is almost unknown. It can do no harm to refer to the still more general opinion of one of the juries of the Great Exhibition—

"In reporting on the hydraulic machines exhibited, it is impossible to refrain from adverting to the general neglect of those elementary principles of scientific knowledge on which the perfection of such machines always depends, and in some cases their whole usefulness in an economical point of view. The Exhibition affords positive evidence of the sacrifice of a large amount of capital, and of much mechanical ingenuity, due simply to the ignorance of certain acknowledged principles of hydraulic science."

That important operation, the surveying of underground works, as usually conducted, is little indebted either to trigonometry, or to the modern improvements in instruments. The compass is almost exclusively used, although its want of accuracy, and its daily and periodical variations are notorious. In approaching old workings filled with water it is dangerous to trust to a plan thus made, and the more so if, as is usually the case, the variation of the compass has not been carefully registered and allowed for. A divided limb, similar to that of a theodolite, added to a compass, would make it thirty times more accurate.

Out of all the illustrations which I have given of the sacrifices entailed by the want of scientific knowledge in mining, none are so striking as the lamentable sacrifice of life and health, in an occupation which presents many dangers for skill and care to overcome. In the coal mines of Great Britain there occur annually 1,000 fatal accidents,—one out of every eight colliers dies a violent death; and the proportion of accidents in other mines does not fall very short of this. An evil of still greater magnitude arises from the heated, or noxious atmosphere in which the miners work, and which is due to the neglect or ignorance of the first principles of pneumatics and ventilation. As far as has been hitherto ascertained, the sacrifice thus entailed amounts to no less than cutting off the miner's life

twelve years before his time, shortening his years of productive labour by one-third, keeping down the amount of this kind of labour in the market by the same proportion, and aggravating unnecessarily the toil and suffering of those who gain their living underground. According to the experiments of Coulomb, the difference of a man's labour in a temperate and in a hot climate is nearly one-half. How much, then, must be sacrificed in mines where the temperature is commonly between 70° and 80°, and has been known to exceed 105°! Add to this, that in the majority of mines the abstraction of oxygen, by the breathing of men and horses, by the lights, and by the decomposition of animal, vegetable, and mineral substances, is so great that candles burn with difficulty; and it will be readily admitted that under a good ventilation the miners could do one-fourth more work, a fact indeed which they have frequently admitted. In Cornwall it is commonly asserted that the cost of the deep mines is so great, in consequence of the heat and the "poor air," that they cannot be carried deeper; whereas science, abundantly confirmed by practice, shows that the deeper the shaft the greater is the amount of natural ventilation produced by it. The state of the mines of this country, which are liable to explosions of firedamp, strongly manifests the want of scientific knowledge. When explosions occur the investigation is almost exclusively directed to the manner in which the gas was fired, instead of inquiring how the gas accumulated. If the air currents passing through the mine were all arranged so as to ascend throughout the workings, from the lowest part to the highest, the gas, being only one-half the weight of air, would run off of itself, and could not possibly accumulate, and consequently no explosion could occur. This arrangement, although required by law in the firedamp mines of France, Belgium, and Prussia, is very rarely carried out in any English colliery, and the neglect of it is the primary cause of nearly all the explosions. Another provision of safety, which has become universal in the above countries, having been determined by the united opinion of the most eminent engineers, is the employment of locked safety lamps in all mines which may contain explosive gases. All the most destructive explosions in England for the last seven years are attributable to the use of naked lights. The cost of working with safety lamps, hardly, if at all, exceeds the cost of working by the light of candles; and yet this indispensable condition of safety, this magnificent discovery in mining science, of which England claims the glory, is repudiated; and 300 lives are annually sacrificed to the opinions of so-called practical men.

Before entering on the educational branch of my subject it may be interesting to view the gradual progress of mining science,

and the extent of our national wealth and importance, which is attributable to it as well as to extraordinary mineral riches, and to Anglo-Saxon enterprise. The history of the application of science to mining is, in fact, the history of the extension of mining operations.

Although there are traces and records of mining operations at a very early period in Britain to obtain tin, lead, iron; gold, &c., it was not until the sixteenth century that they began to rise to their present importance. About that period coal was first employed at Newcastle for other purposes than blacksmiths' fires and burning lime, and a small quantity of copper was sent from Cornwall to South Wales to be smelted. In 1690, the Mundic copper ores were first smelted, and were brought for that purpose to Bristol by Sir Gilbert Clark. In 1726, the amount of copper ore raised in Cornwall was 5,000 tons; in 1853, it amounted to 189,000 tons, yielding 11,839 tons of copper, being one-third of the whole production of Europe, and worth 1,124,561*l*. Poorer ores are now worked, so that in the same period the yield of pure copper has decreased from 11½ per cent. to 7½ per cent. The amount of tin ore raised in Cornwall and Devon, in 1853, was 8,866 tons, valued at 600,000*l*., forming about nine-tenths the production of Europe. The production of lead in the United Kingdom reached 65,000 tons, and of silver, 818,000 ounces.

In the year 1750, before the general application of pit-coal to smelting, the quantity of iron made was 30,000 tons; now it amounts to upwards of 2¼ million tons annually. The consumption of coal in London in the year 1700 was 470,000 tons; it now exceeds 4,000,000, whilst the production of Great Britain has increased to 54,500,000 tons. The following table will illustrate the relative productiveness of some of the principal countries:—

	Area of Coal Districts.	Production in 1852.
Great Britain ..	5,000,000 acres	50,000,000 tons.
Belgium	370,000 acres	6,500,000 tons.
France	740,000 acres	5,500,000 tons.
Prussia.....	390,000 acres	6,000,000 tons.

The improvement in the operation of clearing the mines of water, and to which their great extension has chiefly been owing, dates from about 1700; they were drained previously by chain-pumps, worked by water-wheels of small diameter. About that time, Costar first introduced water-wheels of from fifteen to forty feet in diameter, of the kind which are still occasionally used.

In 1696, Savery wrote a pamphlet entitled the "Miner's Friend," to explain his method of "raising water by the impellent force of fire," but he failed in introducing his engine.

The first steam-engine applied to pumping water from mines was Newcomen's, at Griff Colliery, near Coventry. It was immediately after applied to the Huel Vor Mine, in 1713; but in 1740 there was still only one steam-engine in Cornwall. The first underground engine was erected in 1776, at Whitehaven. Watt's first patent, in 1769, opened a new era in the application of power, leading eventually to the Cornish pumping-engine, which presents the highest economy hitherto attained by machinery. The "duty," as it is called, of such engines, has occasionally exceeded one hundred million pounds, raised a foot high, by the consumption of a bushel of coals. Probably the most remarkable instance of the application of pumping-power, was during the sinking of the Dawdon shafts. There were eighteen lifts of pumps employed, each of 19⅓ inches diameter, and nine lifts of 16 inches. The horse-power amounted to 1310, and 10,000 gallons of water were pumped up per minute, which was afterwards stopped back and the shaft made perfectly dry by lining the shaft with cast-iron tubbing.

Minerals were originally raised to the surface by means of the common windlass, and afterwards by the horse, when the water-wheel was next applied, and on the introduction of Newcomen's engine the water expended was sometimes pumped up again by it. A water-wheel, with double buckets, in order to reverse the motion and alternately raise or lower the rope, succeeded. This was improved by Smeaton, who retained the single buckets, but made the rope-roll to throw out of gear and reverse. A stride further in the march of improvement was to apply Watt's engine directly to the rope-roll by means of a crank. Now, we have direct-action engines of 200 horse power, applied to a rope-roll or drum of sixteen feet diameter, capable of being controlled by a child, which draw two tons at a time from a depth of 500 or 600 yards, at a speed of twenty miles per hour, and bring to the surface 800 tons of coal per day. This high speed can only be attained by having guides fixed to the sides of the shaft, which answer the same purpose as the rails on a railway. It is calculated that wooden guides save their first cost twice over in the first year, and yet less than half the coal mines, and very few of the metallic mines, have adopted them. The great extent of the Newcastle mines has called for improvements in underground haulage. By means of underground engines and endless wire ropes, planes of 1,000 to 3,000 yards in length are worked like the original system on the Blackwall Railway, at a speed of from ten to fifteen miles per hour. The result of these improvements is that the expense of bringing the coal to the surface in some of the largest mines is one-third of the cost in that large number where mechanical science is unknown.

To the demand for fossil fuel, consequent on the early exhaustion of our forests, we owe the first germs of the railway system. For these, as well as the application of the locomotive to edge rails, we must look to the engineering talent of the North of England collieries. Beaumont introduced wooden rails into Durham, in 1630, which were followed by the cast-iron tramways, invented by Curr. Wooden sledges, trams with wooden wheels running on planks, ending with cast-iron wheels, and flanged wrought-iron wheels, were the halting-places in the gradual order of development.

The scientific principles of ventilation were laid down in 1764 by the French academician Jars. In 1760 Spedding, of Newcastle, first carried the air in one current into every part of a mine, but it was left for Mr. Buddle, in 1813, to introduce the greatest improvement in modern ventilation—the splitting of the air, which is simply providing several channels for the air to pass through the workings in lieu of one. By this means it is evident that a much larger quantity of air, and consequently in a cooler and purer state, flows through the mine.

To Humboldt, in 1796, the miner is indebted for a safety-lamp to enter poisonous gases, of which he thus writes:—"No fear need be entertained of igniting explosive gases in mines in using this lamp, which is supplied by a reservoir of common air;" but it is to George Stephenson and Davy that we owe the splendid invention, in 1815, of the present convenient safety-lamp for working mines which give off carburetted hydrogen. It has now sustained a trial of thirty-eight years, at least in the north of England, without one well-ascertained case of failure. All statistics combine in showing that its universal introduction would alone render the miner's most deadly enemy almost powerless to destroy.

The ventilation of metallic mines would seem to be looked upon as one of the special missions of the winds of heaven, for there the science of ventilation is almost unknown. The small effect due to natural ventilation is nearly lost by allowing the air-galleries to become contracted, or the air to leak away from one shaft to the other by the shortest way it can find, so that hardly any penetrates into the extremities of the mine where the hard work is going on, and where oxygen, the fuel of the animal system, is being converted into muscular work. For a century and more furnaces have been applied to the bottom of the shaft where the air is intended to ascend, called the upcast shaft, and they are now common in the coal-mines. They heat and rarify the air, so that it ascends the shaft, whilst cold air necessarily descends another shaft to supply its place. An ordinary room, with a fire and chimney, presents an exactly analogous case.

The air from the outside descends through the doors and windows, by the shortest course to the chimney, and these currents have in a mine to be turned aside and directed so as to traverse every part, and reach the points where the men are at work. The quantity of air which thus enters the Hetton colliery, the largest in the world, is upwards of 200,000 cubic feet of air per minute, equal to a cube of air of which each side measures sixty feet in length. Twelve tons of coal are consumed by the three furnaces in every twenty-four hours. In Belgium, where the science of ventilation is better understood than in England, the furnaces are being replaced by machines which pump out the air; the number of such ventilators already amounts to 182, driven by steam-engines of the united power of 2,200 horses. They are not only free from the danger of exploding fire-damp, but are more regular in their action, more under control, and more economical than furnaces. It seems as if we stood, on the whole, in the same relation to the continent in respect of mining, as we do in manufactures generally—necessity and energy have triumphed amongst us over the more important difficulties, and from us they have hitherto received the most essential improvements. They are ever on the watch, and eagerly adopt each step of our progress, and we should certainly be wanting in commercial enterprise if we fail to appropriate the science and refinement by which they are rapidly compensating for their deficiencies in the raw material. We have much to learn in regard to the safety of mines, in boring, in machines for raising men, in the extraction of the whole of the minerals, and in coking. Within the last thirty years the labours of D'Oeynbrausen, Degousée, and Kind, have raised boring to the rank of a mechanical science. Fauvelle, by his system of hollow rods and a current of water, to clear away the debris, bored at Perpignan 183 yards in twenty-three days. Mulot, encouraged and advised by Arago, persevered with the well at Grenelle from 1833 to 1847, till it attained a depth of 600 yards, and yielded 740,000 gallons of water per day. Borings for salt springs, to 764 yards in depth, at Mondorff, and at Minden to 742 yards, have been executed by Kind, the so-called "Napoleon" of borers. He has also bored shafts of fourteen feet in diameter, and at Homburg is now executing a boring to a still greater depth, to obtain water of a sufficient temperature for hot baths, without the cost of reheating.

A memorable stimulus was given to improvements in mining in Belgium, by the premiums awarded by the Royal Academy of Sciences, in 1840; since which time greater progress has been made in the application of science to mining than in any other

country in a similar period. The production of coal in fourteen years has increased to the wonderful extent of 117 per cent., and the number of workmen by 53 per cent., whilst the price of coal has diminished from 11*s.* to 6*s.* 8*d.* per ton. We shall not be surprised at such a result if we consider the training of the leading engineers of that country, as well as of France. The first pupil at the University of Liege, and at the École Polytechnique at Paris,—equivalent to a senior wrangler,—enters each year the Écoles des Mines at those places. A three-years' course, accompanied by periodical visits to mines, and several stringent examinations, qualifies the pupil as an aspirant engineer. He is then employed constantly in visiting and reporting on mines, or takes the management of private works for periods of five or ten years. The wisdom of those two countries has thus selected their highest talent for the promotion of the interests of mining: it combines the best practice with the highest science, and is forming a body of men to whom may be safely referred for solution the wants and the difficulties which affect the art of production in all its branches. The able work of the Inspector-general Combes, on the "Exploitation" of Mines, and the accurate investigations and descriptions of practical subjects, and the progress of other countries given in the Annales des Mines, and Annales des Travaux Publics, would testify to the ability of these engineers, even were they wanting in the names of Dufrenoy, Élie de Beaumont, Regnault, Le Play, Gonot, Dumont, and Mueseler.

In giving a hasty sketch of the efforts which have been made to introduce mining education, the first place must be conceded to the Academy of Freiberg. Although lectures were given by Dr. Henckel in his own house till 1744, the school was not founded till 1765. It attained its greatest celebrity in 1775, under the famous Werner. Pupils are to be found there from distant countries,—Spain, Russia, and the Brazils. Some of the leading proprietors of mines and smelters in this country have taken advantage of the education it affords. The subjects are taught by lectures, illustrated by diagrams, by experiments, by models, and specimens. One day in the week is spent in the mines of coal, iron, tin, &c., of which there are 100 within three miles of Freiberg. Besides the higher classes, there is one for managers or captains, of whom the number is restricted to forty. The course consists of arithmetic, geometry, art of mining, elementary mineralogy, grammar, and drawing. For an account of the other celebrated schools of Tarnowitz, Schemnitz, and St. Etienne, &c., and the experience to be derived from their past history, a pamphlet just published by Professor W. Smyth

should be referred to. The mining schools at Liège and Paris, established in 1810, to which I have already alluded, are schools of the highest scientific character. At Alais, in the Department du Gard, a school for master miners, under the direction of M. Etienne Dupont, affords some useful suggestions for the class of mining schools which are chiefly required in this country. The director says, "This school has an essentially practical object: the certificated pupils are workmen who can be formed into managers or master miners. Only workmen above the age of sixteen years, who have worked in the mines for at least a year, are admitted. The attainments required for entering are reading, writing a running hand, the four first rules of arithmetic, and elementary notions respecting the systems of weights and measures." M. Dupont has handsomely offered to educate any mining schoolmasters who might be sent out to him from England, at a very moderte rate.

I have now to return to mining education in England, and to acknowledge the high position held by the School of Mines in Jermyn Street, under the able presidency of Sir Henry Delabeche, and conducted by professors of the first talent. Although distant from the centres of mining operations, it has the advantages arising from the Geological Survey, from the fine museum which illustrates it, and from the laboratories and mining records. Field instruction is given in geology, mineralogy, and palæontology. Useful as this institution at present is, as a centre for mining information, it may yet hold a still more distinguished position, as the active supporter of the mining schools which are now being formed in the principal districts. An interesting account is given of its formation, in a report made last year by M. Coquiel to the Belgian government, on Industrial Education in England. He says:—"The School of Mines and Science applied to the Arts, projected in 1839, was not inaugurated till 1851. Before that, no institution existed in the United Kingdom, where the different sciences applied to the *exploitation* of mines were taught. It is surprising that a country whose riches and prosperity are due in a great measure to mines, from which minerals are produced amounting to the annual value of twenty-four million sterling; that is to say, to nearly four-ninths of the whole produce of Europe, and from whose soil is extracted annually more than 35 million tons of coal alone, has not thought of furnishing to the numerous population occupied in working its mines, the means of acquiring the most elementary scientific notions of their art. And yet the industry of which we speak, is precisely that which can least do without scientific knowledge. The help of geology and che-

mistry is required to discover the formation, and determine the nature of a mineral; that of physics and mechanics for the *exploitation*, strictly speaking, of the mine; that of metallurgy to treat the metal when it is extracted from the earth. At every moment (and the instances are but too numerous in England), ignorance of science may not only occasion the death of miners, but the loss of immense capital, or at least deprive capitalists of the advantages which a more intelligent mode of working would have assured to them. Might it not be said that the English, to whom Nature has been so generous, so prodigal, act somewhat in the same manner as those southern nations to whom Heaven has given warmth and food almost for nothing, and who had rather fold their arms in the face of these favours, than apply their intelligence and their strength in profiting by them? Indeed, all the countries of Europe, less gifted than England in respect of mineral riches, have established schools to compensate for their relatively unfavourable position, by improvements in the means of working.

"That which creates the most surprise is, that the companies and proprietors of mines so rich, so extensive, so numerous as they are in Great Britain, have not established schools from which they might themselves obtain the greatest advantages. They had before them the example of the immortal Watt who, having obtained a patent for the ingenious improvements which he had introduced into the steam engine, established at Soho, near Birmingham, a 'preparatory school,' in order to teach the workmen not only the new series of works which he was about to entrust to them, but the principles of the operations themselves, drawing, measuring, adjusting, &c. A single attempt has been made in Cornwall, by Sir C. Lemon. In 1838 he established, at his own cost, a school of mines, with the object of showing the importance of similar establishments. The school went on for two years; and Sir C. Lemon offered to the mining interests of the county of Cornwall, a sum of 10,000*l.*, if, on their side, they would give a similar sum to found a permanent school. Neither the county nor the mining interests answered to this appeal; and the school was abandoned. During the two years of its existence, it afforded instruction to seventeen young men, whose history has been ascertained. Almost all have obtained superior situations; and occupy a recognised place in society. They are anxious to acknowledge that they owe their success to the school founded by Sir C. Lemon. What eloquent pleading in favour of professional education!"

Just as it is desirable to take the opinion which others entertain of us, rather than our own, it is sometimes very useful to

see if we can learn something from the opinion of an intelligent foreigner; and as the most desirable part of the education in our mining schools should be the imparting with accurate details all the best examples of practice in our own land, I trust that those who have the direction of our future mining schools will not neglect to appropriate all that is advantageous in foreign mines. As an example of an accurate description of a mining process, such as we require, I refer with pleasure to a description of tubbing shafts, by "A Newcastle Collier," in a recent number of the *Mining Journal*. It is too long for quotation. For descriptions of foreign mining, the work of M. Combes and the annals before-mentioned can be consulted with confidence. There are four institutions in Great Britain which must not be overlooked, but which, without including any special instruction in mining, have furnished much valuable knowledge to those engaged in its pursuit: I mean the Universities of Dublin, Edinburgh, Durham, and London. The department of applied sciences was established at Durham in 1838; at King's College, by the exertions of three eminent professors, Moseley, Hall, and Daniell, in 1831. The two former gentlemen gave their services to Sir C. Lemon's school, and Canon Moseley, the Inspector of Training Schools, is now actively engaged in forming schools of Practical Science, or, as they are called, "Trade Schools." Another of Her Majesty's Inspectors, the Rev. J. P. Norris, has been instrumental in forming, on the suggestion of Mr. Tremenheere, five prize schemes in the mining districts of Staffordshire and Cheshire. Their object is to induce the parents of children (in a district where high wages offer powerful temptations) to keep them at school after ten years of age, and for a longer peried than the average fifteen months. Two conditions he finds to be essential:—

1. That the prizes should not be attainable without positive effort on the part of the candidates.

2. That they should be of such a kind as to make a lasting impression upon the child, and so large in amount as to carry with them perforce a sense of increased responsibility.

At the Dudley examination last year, there were 150 competitors, from eleven to fourteen years of age. The prizes are provided by subscription amongst the proprietors of works. Although this is a successful method of improving elementary education, I think we may fairly expect that by offering instruction to boys or men, by which they may obtain a higher position and better wages, they will see more clearly the advantage of the elementary knowledge which they must acquire before entering a mining school. In the month of May, in the present year, a meeting of the coal trade of Great Britain was held in

London, at the request of a committee of the House of Commons, at which the following resolutions were passed :—

RESOLVED,—

"That it is the opinion of this meeting that a large number of accidents in collieries arise from the ignorance and recklessness of the miners themselves: and that increased education would greatly tend to decrease the number of accidents arising from such causes; . . . . and in the opinion of this meeting, the owners of collieries should, in connection with the workmen, make such arrangements in a financial point of view, as will accomplish this desirable object." It was also further—

RESOLVED,—

"That this meeting is of opinion it would be of essential service, in the future management of mines, and consequently have a tendency towards the prevention of accidents, if a central mining school or college of a practical nature was established in some convenient and suitable colliery district, with branches therefrom and connected therewith, for the education of mining engineers and other officers or subordinate persons to be entrusted with the management and conducting of the mines of this country. And that the committee now sitting on accidents in mines be solicited to take this subject into their serious consideration, with a view of recommending the Government to afford such aid as they may deem advisable and requisite to establish and support so necessary and laudable a measure."

This was followed by a strong expression of opinion on the part of the committee.

"Your committee cannot too thoroughly recommend the establishment of similar institutions in other districts, at which the branches of science bearing upon mining should be taught.

"Facilities would thus be afforded for imparting to the superintendents or overlookers, upon whom the daily and hourly conduct of the mines necessarily falls, an amount of scientific information which could not fail to induce greater vigilance in carrying out rules and precautions, obvious enough to scientific men, but which it is difficult, if not almost impossible, to have faithfully realised in practice by those who, however willing to do their duty, do not fully understand or appreciate the value of such rules and precautions. Your committee believe that the increased scientific information thus afforded to this class of men (the overlookers) would prove an important step towards lessening the number of accidents in coal mines, and more especially those arising from defective arrangements of ventilation; and they would urge upon Government to foster, by grants in aid, the establishment and maintenance of mining schools in the large mining districts throughout the country."

There are at present four mining schools which are about to

be commenced by the exertions of the proprietors and managers of mines.

The noble efforts of Sir Charles Lemon have not been without their fruit. 1,500*l.* is already subscribed in Cornwall, and a county meeting is called for the 12th of September to inaugurate a central school at Truro. The Newcastle School, which is formed under the auspices of Mr. Nicholas Wood, and the North of England Institute of Mining Engineers, will be in operation before the close of the year. The town of Swansea last November appointed a committee to carry out a mining and trade school; and at Bristol, the proprietors of mines having published their opinion that "the necessity of a mining school has long been felt, especially in the difficulty so generally experienced by the proprietors of mines, to obtain intelligent men to act in the capacity of bailiffs, overmen, deputies," &c., are actively obtaining subscriptions to commence a central school.

Their prospectus includes three objects:—

"1st.—A thorough Mining School where all the practical duties connected with mining, machinery, &c., shall be taught at the lowest possible rate, so as to enable the children of the better-paid working men of this district to attend.

"2nd.—Lectures and courses of instruction at convenient times, to enable those who cannot study at such an Institution *entirely*, to obtain information on any particular branch of the subject.

"3rd.—The bringing out of cheap maps, diagrams, books, &c., suitable for schools, and that will enable the teachers of our National, British, and other Day Schools, in mining districts, to impart to the children a *general* knowledge of geology, mining, &c."

To explain the course which we propose to carry out at the Bristol and Swansea Schools, I may be permitted to quote from the reply which I had the honour to make to the inquiries of the Bristol Committee.

"The overmen and deputies, or bailiffs and under-bailiffs, are everywhere a hard-working, pushing class of men, very anxious to obtain information, provided it applies itself directly to their daily occupations, and the information which I propose should be given is of this very kind, both in the adult evening classes and in the day-schools, although in the latter more elementary knowledge must necessarily be added. Boys from twelve years and upwards who can read, write, and do the rule of three, having, perhaps, already worked in the mines, will be taught the *science of practice* divested of everything abstract, and consisting for the most part of those rules, by the application of which their labour may be improved and shortened. The heads of the studies will be

writing, book-keeping, drawing (free-hand and by compasses), arithmetic, geometry, surveying, geology, metallurgy, mechanics, machinery, mining. As an example of the subdivisions of these subjects, the last head includes boring, sinking shafts, tubbing, laying out top and bottom roads, winding, pumping, haulage, timbering and walling, the various methods of working coal, and the cost of all the above; blasting, ventilation, gases, explosions, the strength of ropes, chains, and materials, their cost and application, accidents and subjects belonging to safety, &c. Surveying should be taught in the mine and in the field, on a system superior to that ordinarily in use; mechanics should be illustrated as far as possible by models; machinery and mining by obtaining access to the large works or the mines, in which respects Bristol is advantageously situated. The situation is central for the Forest of Dean and Monmouthshire, both by position and by a connection in trade. It offers the advantages of museums, laboratories, models, the facility of obtaining lecturers, and the probability of a large influx of scholars unconnected with mining, who by assisting in the payment of the school expenses will enable them to be placed at the lowest figure. Thus it may gradually become a trade school without deviating at all from its strict object, and pupil teachers from the national or other schools, intended for places in the mining districts, may take advantage of the technical instruction sufficiently to render the teaching in their elementary schools more useful, and spread far and wide amongst the mining classes the inclination and the means of becoming better acquainted with those operations on which their livelihood depends. It is not a little remarkable that nowhere in England, so far as I know, is the mechanic instructed in those simple rules by which he may avoid failures, shorten labour, raise his own value, and improve his art. It is not in any way supposed that this instruction should qualify a man for becoming at once a bailiff or an under-bailiff. Manual labour will form no part of the course now proposed. For this he must go back to the mine, and the handicraft of the miner must be learnt by the sweat of his brow, but his superior intelligence will soon mark him out for gradual promotion; and having learnt to understand every branch of his trade, he will, when advanced to positions of trust, become a very superior and efficient overman. Many of those in the adult class will possess the advantages of practice and experience, and it is, therefore, to this class that we must probably devote the most attention, in order to obtain the earliest evidence of the success of the school.

If the cost of education is fixed at 2*l.* per year, it will be within the reach of any of the mining classes who have an

earnest desire to improve, and a three-years' course will suffice for obtaining all the information which the school can offer. Examinations may be held annually, and money and other prizes and certificates of merit or of approval granted. For the accomplishment of these objects, a fund for the purchase of models and apparatus will be required, and a sum of at least 400*l.* per annum for rent, lighting, and heating, two masters' salaries, books, and apparatus. The Government are inclined to guarantee, when desirable, the salaries for the masters for a short period; to find diagrams, prepared by eminent men, at half cost; philosophical apparatus at one-third cost, and to pay salaries to pupil teachers. With the exception of the first I think these offers may advantageously be accepted. The Mining School can place itself in connection with the School of Mines in Jermyn-street, of which Sir Henry Delabeche is the director, so as to take advantage of its experience and assistance, and to open out its exhibitions, and other means of higher instruction, to the more promising pupils, without the school being in any way restricted in return.

In choosing a building it is advisable to make provision for 200 pupils in one school-room, for a lecture-room of nearly equal size attached to it, with a room for drawing and preserving models, and a fourth room for a laboratory and workshop; convenience for washing being also provided near the entrance.

The principal difficulty which presents itself to me is that of obtaining a suitable head-master. The second, or mathematical master, may be advantageously procured from the Greenwich Hospital schools, at a salary of about 80*l.* per year. The head-master must necessarily be acquainted with practical sciences, but the knowledge of mining, of the kind which I propose should be taught, is confined to very few. I am now preparing a complete syllabus of the course of instruction for the approval of the committee. When they have selected a proper head-master, I shall be ready, as far as lies in my power, to afford him the means of completing his information, and to deliver a course of lectures on the more technical subjects.

It will be perceived, I hope, that in this outline of the advantages and instruction to be derived from the Bristol Mining School, I have endeavoured to adopt the views of the proprietors and managers of collieries in the South of England and Wales, so far as I have been able to ascertain them. From the enlightened opinions of these gentlemen, from the scarcity of competent overmen or bailiffs, from the increasing depth, extent, and difficulty of coal-workings, I feel confident that the committee will meet with support from all parts of these three counties. We need not fear inadequate funds. It depends,

however, on the extent of the contributions on the part of the proprietors, whether the head pupils in each yearly examination may be rewarded by scholarships adequate to support them during the term of study, and whether the best masters and mode of instruction are employed. Every subscriber of 10*l.* annually may be allowed to nominate one or more free pupils. The most material aid which can be afforded is to send us pupils; when the mining classes have found the benefit of, and the way to, REAL instruction, they will seek it for themselves."

I may mention that only this morning I received an offer from a colliery proprietor to subscribe 30*l.* a year to these schools.

To take the whole question of which I have been treating from another point of view; it has been truly stated, by more than one writer, that the tendency of civilization is to render intelligence the only condition of superiority in production. The want of professional education, organized on an extended scale, and intended to serve as a complement to the natural resources which a country possesses in developing its production, is generally felt by all men whose ideas tend to turn the scale of public opinion. The Exhibition of 1851 has awakened the national feeling, and given impulse to a movement which increases from day to day. I cannot more appropriately conclude than in the words of a foreigner: This exhibition itself arose from the idea on which professional education is based. It will assuredly, eventually finish by expanding into a magnificent industrial education, which will serve before long as a model to all the nations of the continent. This would truly be a great and noble enterprise, worthy of the people who for twenty-five years have given the signal for all the great reforms which civilization has adopted. The English government, in favouring this movement, will only remain faithful to the programme of improvements, which appear for many years to have been the object of its most lively solicitude. To cheapen the necessaries of life, to elevate the working classes, have been the avowed aim of the greatest statesmen of England.

THE NECESSITY OF AN EXTENDED EDUCATION FOR THE EDUCATOR.

By the Rev. G. E. L. Cotton, M.A., *Master of Marlborough College, and late Fellow of Trinity College, Cambridge.*

I feel that the first sentence of this lecture ought to be an apology for venturing to give it. I have never been in any way concerned with the management of a training college, or the education of those classes in whom the present audience are mainly interested, and for whose benefit this exhibition is especially designed. My experience has been entirely in the large public schools of England, and with the preparation for the universities, and what are called the liberal professions. Thus, when I was asked to lecture in this place, I felt considerable doubts as to my fitness to do so at all, and as to the subject which I should choose. For example, it would have been a mere impertinence in me to attempt to advise you as to the method of teaching geography, or any of those branches of study which are imparted with such success by properly-qualified teachers of the poorer classes. In these points the masters of our public schools should rather go as learners to the training colleges, than attempt to instruct them. Among the many links which unite the different orders of society in England, and in which they react upon, and benefit each other, I hope that this of education will be one; that, if those who are called the upper classes, by their example, influence, subscriptions, active exertions, promote and encourage the education of the lower, they will be rewarded by finding that their own children are the better for it, and that many improvements in teaching, intended for the especial benefit of the poor, are no less applicable to the education of the rich. But I hoped, that though unfit to offer you any suggestions on particular points, yet I might attempt to guide your thoughts on a more general subject. Edu-

cation, in its details, is infinitely various; one part of it is specially applicable to one class of society, and one to another: this study is particularly wanted for one profession or calling, and that for another, but education in itself is the same for all; the general principles on which it rests are applicable alike to all classes; the necessity of it presses equally on the highest and the lowest; it has instruments for training the human mind, studies to which all should be at least introduced, independent of all particular professions and callings, and tastes. Every child born into the world receives from God the right to grow up an educated man, to cultivate his mind according to the measure of the powers which he has received. Now, what do we mean by an educated man? Not plainly a man fitted to perform the duties of some special calling, whether high or low. A clergyman who knows nothing but divinity, a lawyer whose studies have been limited to Coke upon Littleton, is not an educated man in this best sense, any more than a farmer, whose knowledge has been confined to the ordinary operations of agriculture, or a carpenter who can make tables, or a shoemaker who can neatly handle his awl. I need not go out of my way to search for an elaborate definition of education: I am content to take the one which has been fixed as the principle of this educational exhibition, inasmuch as it was laid down in the inaugural lecture. Dr. Whewell* explained education to be the process by which an individual is made a participator in the rational, the true, the beautiful, and the good. Now, if this be so, it is plain that universal education, though it may use different instruments to train men to these lofty perceptions, and though it should not forget the future business, and probable position of those whom it is guiding, must yet be independent of these various instruments, and that it has general ends of its own, quite separate from the special ends of making any one a good clergyman, a clever lawyer, a successful farmer, a skilful carpenter, or a neat shoemaker. This aim is to make him a wise and thoughtful man. It is well known that some years ago, before the present general movement in favour of education began, such a view was entirely denied, and it was agreed that to educate the poor was quite unnecessary; that their business was to work by day and rest by night, to be respectful to their superiors, and contented with their position, and to save up a little money for their old age, which would probably be increased by the charity of their richer neighbours. But it was found in course of time that such a view, whether right or wrong, was at least impracticable; that the development of the English nation in com-

* Lecture on the "Material Helps of Education."

merce, trade, manufactures, and population would not suffer it to be acted on, and so now we have witnessed an entire revolution in men's language, and all classes seem to vie with each other in promoting education of some sort. Since public attention has been called to the subject of juvenile crime, and to the facts brought to light by our census returns, our police courts, our ragged and reformatory schools, we may rejoice in having enlisted all good men on our side. Every thoughtful and religious person has made up his mind that it is a positive crime to allow the existence of so awful a state of things without exerting himself to apply the remedy of education. But there are still various opinions as to the manner and degree in which this remedy is to be used, and I cannot help thinking that there has lately been a tendency to overlook the general education for the sake of the particular; to train men up to be useful in particular callings (especially of a mechanical character), rather than to cultivate the faculties and tastes which are common to all. Commerce, material industry, physical development, are in the first place the characteristics of our age. A great impulse, too, was given to this special instruction, by a cause of which no one would speak, least of all in this place, without the deepest gratitude; I mean the exhibition of 1851, which pre-eminently called attention to the subject of industrial education. This has been most actively and wisely carried on by the Society of Arts; the deficiency of England in this matter, compared with foreign countries, has been earnestly and properly insisted on, and vigorous measures have been adopted for our improvement. To all such efforts we should cordially wish success, but at the same time we may venture to plead the cause of a more general culture, to protest against our being deafened to it by the din of steam-engines, to entreat that the material and useful view of education may not persuade us to forget the moral and intellectual training of the mind. Within the last year a fresh impulse has been given in the same practical direction. We are now all to teach and to be taught *common things*. Now, let me at once say, that as we are under a great obligation to all the promoters of that wider industrial education of which I have spoken, so also we are deeply indebted to those who are so vigorously and properly advocating such knowledge as makes the poor more comfortable, and more expert in the operations from which they derive their subsistence. If industrial education, either in its higher or lower branches, were only regarded as a means of developing trade, of enabling men to get their living honestly, and engaging them in healthy occupation, its value to our country would be inestimable. But plainly, it does more than this: the imitation of beautiful manufactures, the

invention of elegant patterns and designs, is in some sort an education in art; to understand practically the processes of Nature, is an introduction at least to natural science: to do the commonest things well and intelligently, is to lay the foundation for habits of diligence and order, and therefore all who promote industrial schools are really benefactors to their fellow-countrymen. At the same time, there is a danger lest a bad use should be made of this recent development, lest the current should set in so violently as to carry away everything along with it: lest those who still regard the education of the poor with suspicion and distrust should substitute this instruction in common things for that which is education in the truest and highest sense. It is well, therefore, that we should all remember that such teaching as this, whether concerned with the most wonderful practical results of scientific genius, or the commonest process of every-day life, must not engross to itself the whole education of the people.

The division of human nature into three parts,—the spiritual, the intellectual, and the bodily,—is more than once stated or implied in the New Testament.* Now no one can possibly deny, that it is right for all men to train and strengthen their bodies, to make them active, healthy, ready for vigorous employment. Still less could any one venture to assert that we may neglect to cultivate our immortal spirits, that we ought to make ourselves in the highest possible degree moral and religious, to conform our characters to the likeness of God. Therefore it is the right and duty of all to train their understandings, to become as wise as they can, to learn as much, to know as much, to raise themselves as high as their abilities permit. Those who deny this either really or openly, or which is perhaps more common, unconsciously, and by their conduct practically forget that God, who is the Creator of the Spirit, is also the Author of the Mind, and that every work of His hand, every gift of His bounty, is bestowed on us that we may cultivate and improve it. Now men are capable of receiving higher truths than those which concern baking and ironing, or even those connected with railways, manufactures, and trade. Between this instruction and that education in the spiritual knowledge of God, which is the highest of all, there lies a wide and fair domain, into which the human mind should

* 1 Thess. v. 23; 1 Cor. ii. 14 ff; iii. 1 ff. See Dr. Arnold's Sermon on the first passage (vol. i. Sermon xxvi.), and the quotation from Suidas, which he gives in a note. Plato's division of human nature in the *Republic* into the *rational*, the *spirited*, and the *concupiscent* elements, is not the same as this, though it resembles it in some respects. See the translation of the Republic, by Mr. Davis and Mr. Vaughan, p. xlv.

be led by those who have to train it. I will not now enter into the vexed question of the classification of the sciences, which so many philosophers have attempted to solve, but in which Bacon himself scarcely succeeded. But, speaking generally, I should say that poetry, and history, and language, and the laws of reasoning, and all that is pure, graceful, and thoughtful in literature, are studies to which the more intelligent of our poorer classes should, if possible, be introduced, which those who are in earnest about educating the people may well hope to see extending every year, more and more widely among them. Neither should we forget, that he who is to think and argue, and judge correctly, must understand laws of mathematical no less than of moral reasoning; and therefore on these grounds, quite independently of their connection with physics, we should advocate the instruction of the more intelligent poor in the principles of mathematical science. Yet though all this seems to follow clearly, from the very constitution of our nature, we still hear objections against it. The old arguments against the education of the lower classes are re-produced in a new and more specious form. We are told that the above views are not applicable to the present age. Teach the poor to read and write, it is said, by all means; nay, enable them to boil and bake, and brew and wash, let them, if you will, understand sanatory reasons for ventilation, and keeping their cottages clean and comfortable, and the physical arguments for the rotation of crops, and other means of making their gardens and fields productive, *but do not educate them above their position in life*. Of what possible use, it is argued, can history, poetry, and mathematics be to shopkeepers and labourers? If you set all the poor people reading Shakspere and Milton, or working propositions in geometry and mechanics, you will very soon make them discontented and lazy, you will unfit them for the work which Providence has assigned them, we shall have no housemaids, no footmen, society will be overturned. Every one ought to be educated in a manner which will fit him for his future occupation. In the upper classes, a boy who is to go to the University, should learn Latin and Greek; if he goes to Cambridge, he had better attend more to mathematics than if he is to reside at Oxford, because thus he will be more likely to get a scholarship of 50*l.* a year, and a fellowship of 200*l.* If he is to be a lawyer, throw the classics overboard, and set him early to Blackstone. If he wants a government appointment, teach him French, German, and modern history. So, too, if a boy is to be a farmer, confine his attention to the subject of turnips, or the respective merits of bone-dust and guano. By all means let the future tradesman learn arithmetic. A servant girl must be able to hem and knit, and make a pud-

ding. Everybody must be taught to read and write; and this, with the religious instruction given by the clergyman, will be quite sufficient for them to do their duty in life, and keep them contented, obedient, and humble. Now those who urge such objections, seem at least to forget that God not only created the body, the soul, and the spirit, but that He has made all men partakers in this triple nature, all of one blood, all sharers of common faculties, and that all have inherited the right and duty of cultivating every part of their nature alike. Or to turn from considerations of theology to those of political science, they surely forget how inconsistent is their view with the boasted equality of Englishmen, with the constitution of a country in which every dignity, but the highest, is said to be accessible to every citizen. Indeed it is manifest that its logical consequence must be the separation of our fellow-countrymen into two classes; the creation of an order of freemen, and an order of bondmen. Indeed that some such feeling as this lies at the bottom of such objections to education, is implied in the epigrammatic saying, "*If a horse knew as much as a man, I could not ride him*,"—to which we at once reply, that we have a right to ride horses, but not human beings. In fact the dangers on which these arguments are founded are most unreal. No doubt it is the tendency of knowledge, unchastened and unhallowed, to make a person conceited and vain; but so it is the tendency of food, improperly taken, to make a man sickly, yet we do not recommend him to starve. Even religion degenerates, sometimes, into superstition and fanaticism, but we do not train up our people as atheists. The dangers of gluttony, fanaticism, or intellectual pride are obviated, not by neglecting to cultivate any part of our nature, but by training and improving the whole of it. Besides this, the sounder, the more extensive, the more real knowledge becomes, the less does it minister to pride and vanity. Scraps of information, here and there collected, may incline a man to fancy himself some great one: true wisdom must ever be modest and humble. Again, considering the very little time during which the children remain at school, the stern necessity which obliges their parents to remove them early, that they may help to eke out the scanty income of the family, there is very little present prospect of the mass of the people being over-educated. Besides this, it is abundantly clear that God in His providence divides to each man severally various gifts, talents, and tastes. Some have no inclination for any extensive mental culture; these we must educate as well as we can; we must put them in the way of intellectual improvement, but we cannot compel them to avail themselves of it. As long as the present laws of nature are in force, there is ample security that there will always be

found men to minister to our material wants, no less than to devote themselves to study. But if an increasing number of our countrymen were to take pleasure in reading even such unpractical subjects as history and poetry, I cannot see why any one should be a worse tradesman or farmer because his tastes are elevated and refined. Those who are best acquainted with the manufacturing districts tell us that there the supposed danger is incurred already, and that it only leads to evil where there are none to train and guide and educate the eager student. The mechanics of Lancashire and Yorkshire have far more intellectual acuteness than the agricultural poor. Some of them devote their spare time to a trashy and debasing literature, while many delight in books full of abstruse speculations; but we do not find that the manufactures of our northern counties deteriorate or diminish. We hear, indeed, sometimes, of their listening to revolutionary demagogues, and to teachers who deny the first truths of morals and religion; but this results from the imperfection, not the excess, of their education, and the remedy is to improve their judgment, and knowledge, and reasoning powers, to enable them to detect falsehood and sophistry; to feel that any immoral statement is in itself untrue. We may depend upon it, that if men are to be educated at all, which is now universally admitted, it is sounder policy to educate them as thoroughly as we can, and not leave them half instructed. Those who fear that the progress of education is inconsistent with the continuance of manual labour have never heard of Elihu Burritt, the American blacksmith, who, while he worked vigorously at his calling, made himself master of fifty languages. Let me read you an extract from his journal, as quoted by Lord Carlisle, at a meeting of the Yorkshire Union of Mechanics' Institutes in 1844.

"June 5th.—Read fifty lines of Hebrew, thirty-seven of Celtic, six hours of forging. June 6th.—Read thirty-seven lines of Hebrew, forty lines of Celtic, six hours' forging. 7th.—Sixty lines Hebrew, sixty lines Celtic, fifty-four pages of French, twenty names of stars, five hours' forging. June 10th.—Sunday—100 lines of Hebrew, eighty-five pages of French, four services at church, Bible-class at noon."

I grant that this is an extraordinary case, but it is one that sufficiently illustrates and proves the assertions, that genius is confined to no class of our fellow men, and that literary labour is not inconsistent with a resolute determination to perform our ordinary duties; and though a case of such deep devotion to reading, and to the particular study of languages, does not often occur, yet the great manufacturing town of Lowell, in America, produces numbers, both of men and women, who unite real lite-

rary and scientific taste with hard manual labour, and who are refined and elevated in their general pursuits and character without feeling themselves above the occupations by which they earn their bread. We do not deny the possibility that in a higher walk of life literature may co-exist with practical work. It has never been said that the lamented Talfourd was a careless or partial judge, because he was also a poet and a dramatist. But it is needless to quote isolated instances. The world has seen an example of a really educated people, of a state whose citizens, from the highest to the lowest, were able to appreciate and enjoy the masterworks of genius. Those who have read ancient history with any care and attention will know at once that I allude to the Athenians, and remember the marvellous spectacle which the inhabitants of one small state presented to all future ages, during the time of their great intellectual development, from about 490 to 330 B.C. I say those who have read it with care and attention, because it has been the fashion till within the last few years to think of the Athenian state as a mere rabid democracy; of Athens as a city governed by an inconstant and cruel mob; to parallel the most brilliant period of their republic with the French Reign of Terror. The folly and falsehood of such a view, the infinite superiority of the Athenians, with all their faults, to any other state of antiquity, has been made sufficiently clear to the English reader by the works of Bishop Thirlwall and Mr. Grote, as it might have been always to the students of Greek, by a fair study of the writings of Thucydides and Demosthenes. I at once admit that the Athenians, at the period of their glory, committed great crimes. We need not wonder at this, for while every Athenian citizen had ample opportunity for training his bodily and mental powers, he had no means of cultivating his spirit in the knowledge of God. His culture was not only imperfect, but imperfect in the most essential branch of a true education. But if any one desires to know what effects a mere mental education will produce, let him study the history of Athens for that century and a half. He will see a picture of a people spending days in listening eagerly to the most sublime conceptions of tragedy, unpolluted by any of those immoral accompaniments which defile the modern playhouse, and which have ruined the theatre in a country which can boast of a greater than any Grecian dramatist. He will see them raising up, amidst a landscape of surpassing beauty, marvels of architecture and sculpture, which will instruct all students of art till the end of time. He will find that while Athens was amongst the greatest commercial states of the age, yet her citizens felt the keenest interest in every branch of literature and philosophy, and no speaking was tolerated in their as-

semblies but the most chaste and polished oratory. With minds thus trained to the perception of "the rational, the beautiful, and the true," they cherished feelings of the most exalted patriotism; for the good of their country they submitted to the most bitter sacrifices, and not only so, but not unfrequently they showed themselves capable of a yet wider generosity, and of appreciating the claims of a still more self-denying virtue. When they were seduced into passing an unjust decree, they were no sooner persuaded of their error than they hastened to prevent its execution.* If their greatness was transitory, we must attribute their fall to certain deficiencies in the social and political tendencies of all the Greeks, which prevented any of their republics from establishing a permanent empire. Compared with any of the other states of that age, with the ferocious oligarchy of Sparta, or the base and ignorant mob government of Thebes, the Athenian democracy stands forth with unrivalled purity and lustre. We can only imagine how great the Athenians might have been, if a true spiritual light had guided their marvellous intellectual and physical energy, and enabled them to realize that idea of education after which the whole nation were striving.† We may, however, hope that our own nation, which possesses, by God's mercy, so sure a guide to "the good," may also be led, through the active educational exertions of this age, to the improvement which must result from a deeper appreciation of "the beautiful and the rational." And, as one help to this, it is a happy circumstance that the new Crystal Palace at Sydenham contains so many objects of artistic and historical interest, and that those vast aisles are not wholly occupied by specimens of scientific ability and material enterprise. No one can visit it without deriving even more instruction in what may be called the moral than in the physical sciences; and while we give due honour to the latter, we may at least rejoice in so magnificent a tribute to beauty, to poetry, to history, and to art.

You will complain that I have been speaking to you, and, I am afraid, wearying you for a very long time, and have not said a word on the subject especially assigned to this paper,—the necessity of an extended education *to the educator*. But, in truth,

* Thucyd. iii. c. 49.

† Were it possible to combine the German scientific method with the English power of forming the character, we should attain an idea of education not yet realized in Christian times, *only once realized perhaps in any time in the best days of Greece*; but which it is just the more difficult to attain now, in proportion as the spirit of Christianity is more exalted than anything which antiquity could propose to itself as the end of education.—Wiese's *Letters on Education*, translated by W. D. Arnold.

I hope that I have already proved that necessity. If our desire should be to raise up in England a really educated people, it is plain that those who are to do so should be soundly and efficiently educated themselves. Indeed, it might have been hoped that no one would gainsay the benefits of such an education to the teacher, though he depreciated its indiscriminate application to the taught. But even this has been denied by those who are really, though unintentionally, the opponents of education, while they profess to confine it to what is practically useful. What can be the use, it is argued, of all this farrago of useless knowledge for people who are to teach labourers' sons to spell and work sums in the rule of three? What good do the Government expect by insisting on this vast amount of Euclid and extended historical reading, and English literature, and poetry, and algebra, and chemistry? Twenty years ago, perhaps, the dame who kept the village school might know too little for her office, but she was quite as likely to be useful to the children as those who are taught so far too much. But our hope is, that there may be one day raised up in this country an educated people, that, by the operation of wise laws and material improvements, physical want and suffering may be gradually diminished, that the necessity for close and incessant labour may cease to press down the intellectual energies of the working classes, and that England, in addition to her other claims to greatness, may present to the world the spectacle of an intelligent, and wise, and moral, and religious nation. We trust that soon there will be no part of our population of which it can be said, in the language of a great German writer, "The misfortune has befallen us; the heart of the people is trampled in the mire, and is no longer capable of noble desires."* If, then, this aspiration, for which so many good men have longed and toiled, is not a vain delusion and fantastic dream, the notion of confining the education of the people to mere practical and material studies is altogether mistaken. And, therefore, as I have said, I might well consider my lecture over, for if I have proved the advantage of such an education for the taught, I have *à fortiori* proved it for the teacher. But still, as what is tangible and practical is the order of the day at present, I will venture to ask for your attention for a very short time longer, while I state a few of the more particular benefits which may be expected from this extended and superior education for those who are to educate others.

1. It is quite a mistake to suppose that any lesson can be really attractive or impressive if the learners merely go through

* Haller's *Usong*. It was the original motto to Göthe's Götz von Berlichengen, and is quoted in Wiese's Letters.

a set portion of some appointed book without any illustration on the part of the master. A dead book can never be the same thing as a living teacher. For the teacher should have the tact to apply the book to the particular case of the class which he is teaching. He should know how they can best understand and appreciate it; he should be able to supply from his own stores of knowledge fit illustrations of his subject, such information as is suited for their age and capacities, but which the book has either omitted or assumed. For example, my friend, Mr. Howson, in the lecture which he read here, called attention to the fact that this is pre-eminently true of a geographical lesson. A teacher of this science should know something of languages and etymology, when he comes to the names of places, which prove that a country has been occupied by different races or submitted to different conquerors. If he is ignorant of history, every lesson which he gives loses half its value. So, too, he should know something of the biography of great men, who have made particular towns or districts illustrious; he should not be wholly ignorant of architecture and antiquities, when he speaks of the buried palaces of Nineveh, the ruined temples of Athens and Rome, the transformed mosque of Cordova and Basilica of Constantinople, the living cathedrals of Canterbury, of Milan, of Venice, of Cologne. Whatever a man teaches, he should throw such life and variety into his lessons as to help his class to love reading, and to appreciate the various delights of knowledge.

2. Another reason for giving a liberal and superior education to the teacher is, that he may be, in a marked and distinct manner, above those whom he teaches. A clever pupil soon finds out whether his instructor is a really superior man, or only crammed with a sufficient amount of book knowledge. Nothing so soon diminishes the general, moral, and intellectual influence of a teacher as the discovery that he is not a man of thought and observation, that he cares little for learning in itself, that if the pupil can only attain a certain degree of acquirement, he will be just as able to instruct his teacher as to receive instruction from him. Education ought to be carried on by the mind of an older and really cultivated person acting on that of one who is young and uninstructed, a novice in learning, and whose mind, tastes, and character have yet to be formed. Now it is impossible to describe the thousand influences by which the mind is thus prepared to influence and train others. Passing by, as alien to the present subject, the moral and spiritual preparation necessary for so great a task, we may safely say, that no kind of thoughtful study will be thrown away, that no good and pure taste will be vainly cultivated, but that if only the teacher takes pains wisely and dutifully to educate himself, he will find abundant

opportunities, unsought and unexpected, for extending to others the advantages which he has himself acquired.

3. But it will again be said that this whole view is utopian. A stranger visits a parochial school, and he often is vexed at many signs of ignorance and stupidity, and thinks that it requires very ordinary talents and learning to train children who know so little, and have such slight opportunity to know more. He laments that, just when the boys are reaching an age at which they are capable of appreciating a higher and better kind of instruction, they are withdrawn from the school and employed in manual labour. Perhaps a really active and intelligent teacher is discouraged by the same difficulties, and is disposed to grudge any extra toil to a business which promises so poor a moral and intellectual return. But we must remember that in the midst of many children who are listless and dull, there are certainly one or two in every class who can really understand and value the trouble spent upon them. These are just the pupils who are worth all the labour which a master can bestow upon his office, and for whom a really superior teacher is required. Under the happy arrangements which now exist for encouraging and developing any signs of ability among the poorer classes, by the institution of pupil-teachers and Queen's scholars, it is possible that such children may not be immediately withdrawn from an education by which their parents are able even to gain a tangible and material advantage. But in any case the interest which a teacher feels in his pupils will not cease when they leave the schools, he will find it afterwards a labour of love to follow them to their homes, to help them to continue their studies after their day's work is over, and even if they leave his neighbourhood, to keep up by correspondence the influence he has gained over their minds and characters. Yet surely the fulfilment of this duty will be impossible, it will not even be felt to be a duty, except by those who themselves have tasted and valued the blessings of an extended education.

4. And this leads us in the next place to remark, how essential is such an extended education to the educator, when we regard him not merely as communicating knowledge, but as forming the character, that is, educating in the best and highest sense of the term. A friend of mine, one of Her Majesty's Inspectors, was lamenting the other day that teachers often showed a want of tact in dealing with children, that in remonstrating on some trifling act of carelessness or neglect, they would charge them with violating their most sacred duties, and speak of their conduct as inconsistent with religion. Now it is of course quite true, that every transgression, however slight, is a violation of religious duty; but it does not follow that a child will

appreciate this, that such an argument will be to him either appropriate or convincing. To discriminate between the kind of reproof or argument required in particular cases, is doubtless learned in a great degree by experience and mixing in society; but it is also gained from the additional subjects for thought and observation, and the mental discipline which a man will derive from general and extensive reading. To pursue this question further, would lead me into questions of moral and religious education excluded from the present lecture: it is sufficient to have suggested it as of great importance in connection with our present subject. If there is any truth in what I have been saying, it proves that the teacher must not only seek for a good education while he is a member of a training college, but must recognise the duty of continuing it in after-life; that he must never cease to read and reflect, or to grow in wisdom and knowledge, no less than in general goodness, and in devotion to the great work, which he has undertaken, of training and improving the young. For, if he rests contented with what he has acquired during his own boyhood and youth, and merely trusts to these old stores of thought and information for the benefit of his pupils, he will be like one who draws water from a stagnant pool, instead of seeking it from the ever-flowing springs of a clear and sparkling well.* Old information, a thousand times repeated, unfreshened by added knowledge and wisdom, must at last weary the taught no less than the teacher, and diffuse an atmosphere of dulness over every lesson which he gives, and over all his intercourse with his pupils.†

5. And lastly, the great and conclusive reason why the teachers of our schools for the poorer classes, should seek for an extended education, is that we look on them as the nucleus, as it were, of an intelligent and educated people. What professors are or ought to be to the universities, and men of literature and science to the higher classes of society, this our national schoolmasters ought to be to the mass of the people. It is theirs to leaven the whole lump, to diffuse around them that love of wisdom and admiration of knowledge which alone can raise up in England such a nation as we fondly hope that the next generation at least may, by God's blessing, be permitted to witness. Now, if there are any such teachers present here to-day, let me beg them to learn from what I have said to value the office to which they have been called. I have been told that those educated in

* The comparison occurs somewhere in Dr. Arnold's works.

† So Dr. Arnold—"I am sure that the more active my own mind is, and the more it works upon geat moral and political points, the better for the school, because education is a dynamical, not a mechanical process."

training colleges connected with our English church are sometimes apt to be discontented with their position, and aspire to become clergymen. I should not for a moment assert, that if they feel a real conviction that their tastes and abilities particularly adapt them for that sacred office, they do wrong in seeking it. The answer to this question can only be furnished by their own consciences. But this I do say, that the ambition which makes a man dissatisfied with his position as a schoolmaster, from any notion that by taking holy orders he would rise higher in the scale of society, is a low, false ambition; alike unworthy of the office to which he aspires, and of that which he contemns. For let him be sure that the place of a schoolmaster is in reality and truth a great and solemn ministry, to be discharged for the glory of God, and in dependence on his blessing. It is a ministry, too, which brings with it an abundant reward. If one who is both a clergyman and a schoolmaster may speak to you for a moment from his own observation, I should say that there is no gratitude in the world like the gratitude of schoolboys to one who tries to exert himself, according to his abilities, for their highest good. However careless the mass of boys may be, this at least their warm feelings do abundantly appreciate and value; and what is more, the best of them never forget it. They may grow up to manhood, and become abler, wiser, better men than he who taught them, but they still cheer him with the warmth of their friendship and affectionate respect. That reward, my friends, may be yours—a reward which is not hollow or superficial, like a position in society which values you not for what you are, but for what you are called; but a reward which is real, lasting, true, because it proceeds from the heart, and is addressed to the heart, because it will every year be warmer, fuller, richer, gushing forth like the sap, which is ever supplying fresh life and vigour to the tree.

I have now tried to express to you my thoughts upon a subject of immense importance, but which I feel that, after all, I have treated most unworthily. I can only desire that this lecture may be considered a protest against the notion that we should acquiesce in any instruction, except the highest, and best, and widest which we can obtain, or that any education, short of this, will enable those who teach adequately to fulfil their office. It has been written under the deep conviction that such an education is one of the remedies appointed by God for the evils of society, and that we are all bound as His children and servants to help in carrying it out. I fully admit that it is not the highest and most certain of those remedies, but this is not the place or time to enter into the great question of the connection between religious and

secular education. Let me only remind you, that if education is stunted and imperfect without religion, religion itself cannot produce its full effects without education. We all know the Psalmist's words, that "we are fearfully and wonderfully made," and in nothing is this so clearly shown as in the connection between the different elements which compose our human nature. A man, however religiously disposed, who is the prey to constant bodily sickness, is apt to forget his highest duty by yielding to irritability and ill-temper; a family crowded together in a damp unwholesome cellar, contract habits almost fatal to a real belief in religion, natural or revealed. So if the mind of any one is left uncultivated, his moral character is dwarfed by prejudice; his spiritual vision blinded by defective and unenlightened judgment. Half the theological strife and rancour which distracts mankind, results from ignorance of the facts of language and history, from neglecting to cultivate the reasoning powers; in a word, from defective education; and therefore let me, in conclusion, repeat the hope that on this accounnt, as well as on many others, the end of this exhibition may be to impress upon all classes the conviction that a liberal and extended education is amongst the most pressing wants, I will not say of our age, but of all ages; nor of our nation, but of all nations. We listen, indeed, with reverence and earnest faith to the words, that we must enter as children into the kingdom of heaven, but we are sure that the character contemplated when they were spoken was not a childish ignorance, but a child-like wisdom. We join in the grief and indignation of the poet, when, in anticipation of a purely intellectual education, he exclaimed—

> An age of light,
> Light without love, bursts on my aching sight:*

but we should equally deprecate the opposite danger, were it indeed possible that, as men are now constituted, an age of love without light could continue to exist, and that our best and highest aspirations would not be crushed by ignorance and mental debility.

* Keble's *Christian Year*, Advent Sunday.

ON CLASSES FOR SCIENTIFIC OBSERVATION IN MECHANICS' INSTITUTIONS.

By Robert Hunt, F.R.S.

The Society of Arts in 1852 proposed a system of union to the popular institutions of this kingdom, the object of which was their mutual and general improvement. A large number of the institutions of the country saw, or fancied they saw, that some benefit would be derived from the proposed connection with a metropolitan centre, and these entered into union with the Society of Arts.

I know not of a single instance of fair complaint having been made by any of the institutions. They have, for their very small annual subscriptions, received greatly more than their money's worth. They have sets of useful books for their libraries which they could not have obtained otherwise, They have been enabled to get up exhibitions of an interesting character, through the circulation of specimens of photography nature printing, and other examples of progress by the Society, and they have been enabled to select a better class of lecturers by means of lists which the Society of Arts has published.

Good has been effected in many ways. The Society of Arts deserves much credit for what it has done, but it must do more still, if it would ward off the decay which is slowly, steadily, and surely creeping over the popular institutions of Great Britain. Those valuable institutions have done excellent work, and I hesitate not to state my conviction that one-half of the noble applications of science which so peculiarly distinguish the first half of the nineteeth century, are to be traced to the mechanics' and literary institutions. Many of the most eminent of our living philosophers—using that term in its original and widest sense—

date the kindling of the first spark to those institutions, and I doubt not but embryo Watts and future Davys will be found to be now sitting on the benches of some humble country institutions listening to some itinerating lecturer on science.

But still the mechanics' institutions, the literary and scientific societies, by whatever name they may indeed be called, are, all of them, with a few exceptions—remarkable because *so few*—are very evidently declining. Why is this? The fact being admitted, how is the decline to be checked? How are we to arrest those webs of damp which are involving all that is excellent in these societies which so especially belong to the people.

For more than twenty years I have been a lecturer to these—allow me still to call them—popular assemblies. For nearly eight years—as the secretary of one of the most important and most eminently useful of our county institutions—as a part of my duty, I voluntarily undertook to lecture gratuitously to any institution within fifty miles of my residence. From the Athenæum of Glasgow, in the north, to the small but useful mechanics' institution in St. Just, near the Land's End, in the south, I have extended my lectures. I have visited manufacturing and agricultural districts, cathedral cities and small fishing towns. I mention these facts merely to convince you that I speak from the experience of years:—years, too, spent in careful study of these institutions in prosperity, in adversity, in rapid growth, and in premature decay.

These institutions have effected so large an amount of good that it is with feelings of bitter regret that I perceive them now departing from their original high position, and becoming more and more rivals of the concert-room and of the play-house. Rivals they cannot long continue, for they must soon be beaten out of the field; and since, upon their own showing, we learn that they cannot be supported without concerts and dramatic readings, depend upon it the mechanics' and literary institutions of England are soon to become things that were, unless some new elements are introduced which may give rise to a better state of things.

By the recently published census returns of 1851, we learn that the literary, scientific, and mechanics' institutions of England and Wales were 1,057.

These popular institutions are greatest in number in the manufacturing counties, and least in those which are purely agricultural. For example:—

Oxford county has	...	...	...	3
Bedford	...	...	...	7
Buckingham	...	...	...	6
Dorset ...	...	...	...	6

Then we have in

Chester	38
Cornwall	35
Devonshire	38
Durham	35
Middlesex	77

Now in the manufacturing and mining districts of the north we learn that

Northumberland has	43
Lancashire	97
Yorkshire	189

Of these 155 are in the West Riding. The large number of institutions in this locality is ascribed to the successful working of the Yorkshire Union of Mechanics' Institutions. This union consisted in 1853 of 127 institutions, with an aggregate of between 19,000 and 20,000 members. From the seventy-seven institutions of the metropolitan county, the great learned societies must be deducted, which will leave about fifty working literary, scientific, and mechanics' institutions. Although the returns furnished by the Education Report are valuable, yet we find upon examination that they are very incomplete; and in many cases curious errors may be discovered, which, however, could scarcely be avoided under the circumstances of obtaining the census returns, and the difficulties of so large an examination.

We may, however, fairly estimate that we have in England and Wales nearly 1,000 institutions devoted, under some form or another, to the spread of knowledge, supported by above 200,000 members, and possessing more than 1,000,000 volumes of books.

It is tolerably well known that the formation of adult schools between 1812 and 1818, led the way to the establishment of mechanics' institutions. Now it is a curious fact, that notwithstanding the unmistakeable success of adult schools, they have long ceased to exist. Mechanics' institutions commenced with the organization of the Birmingham Artizans' Library, and the Birmingham Brotherly Society, stating their "objects for improvement shall be reading, writing, arithmetic, geography, natural and civil history, and morals, or in short, whatever may be generally useful to a manufacturer, or as furnishing principles for active benevolence and integrity."

The Andersonian University, at Glasgow, was founded in 1796, Dr. Garnett being appointed to the chair of natural philosophy. He was succeeded in 1799 by Dr. George Birkbeck. "Whilst discharging," says Dr. Birkbeck, "the duties of Professor of Natural Philosophy and Chemistry, in Anderson's Institution, at Glasgow, I had frequent opportunities of observ-

ing the intelligent curiosity of the 'unwashed artificers,' to whose mechanical skill I was often obliged to have recourse; and on one occasion, in particular, my attention was arrested by the inquisitive countenances of a circle of operatives, who had crowded round a model of a centrifugal pump which had been constructed for me in their workshop. I beheld, through every disadvantage of circumstances and appearance, such strong indications of the existence of the unquenchable spirit, and such emanations from 'the heaven-lighted lamp of man,' that the question was forced upon me—'Why are these minds left without the means of obtaining that knowledge which they so ardently desire; and why are the avenues to science barred against them, because they are poor?' It was impossible not to determine that the obstacle should be removed; and I, therefore, resolved to offer them a gratuitous course of elementary philosophical lectures. When the plan was matured, it was mentioned to some of the wise in their generation. They treated it as the dream of youthful enthusiasm, and scarcely condescended to bestow upon it a sneer, for it appeared to them so thoroughly visionary and absurd. They predicted that, if invited, the mechanics would not come; that if they did come, they would not listen; and, if they did listen, they would not comprehend. The offer, however, was made; they came and listened, and conquered—conquered that prejudice which would have consigned them to the dominion of interminable ignorance, and would have shut the gates of knowledge against a large and intelligent portion of mankind for ever."

The prospectus issued by Dr. Birkbeck is an interesting document; and some portion of it applies so forcibly to the present time, that no excuse is required for quoting it.

"I shall, during the next session, deliver a course of lectures upon the *Mechanical affections of solid and fluid bodies*—abounding with experiments, and conducted with the greatest simplicity of expression and familiarity of illustration [it is greatly to be desired that scientific lecturers of the present day would attend to this], solely for persons engaged in the practical exercise of the mechanic arts; men whose situation in early life has precluded the possibility of acquiring even the smallest portion of scientific knowledge, and whose subsequent pursuits, not always affording more than is necessary for their own support and that of their dependent connections, have not enabled them to *purchase* that information which curiosity, too active for penury wholly to repress, or the prevailing bias of their natural genius, might prompt them to obtain. I have become convinced that much pleasure would be communicated to the mechanic in the exercise of his art, and that the mental vacancy which follows

a cessation from bodily toil would often be agreeably occupied by a few systematic philosophical ideas, upon which, at his leisure, he might meditate. It must be acknowledged, too, that greater satisfaction in the execution of machinery must be experienced when the uses to which it may be applied, and the principles upon which it operates are well understood, than where the manual part alone is known, the artist remaining entirely ignorant of everything besides; indeed, I have lately had frequent opportunities of observing, with how much additional alacrity a piece of work has been undertaken, when the circumstances were such as I have now stated. Perhaps, to some, it may appear that the advantages derivable from these lectures will be inconsiderable, or even that they will be disadvantageous, on account of the extent of the subjects which they embrace, and because those to whom they are addressed do not possess the means, or enjoy the opportunities calculated for engrafting upon the elementary truths they learn, the extensive researches of the illustrious philosophers by whom the boundaries of science have been enlarged. Whatever the arrogance of learning may have advanced in condemnation of superficial knowledge, and however firmly I may be persuaded that the people cannot be profound, I have no hesitation in predicting that vast benefit will accrue to the community by every successful endeavour to diffuse the substance of great works, which cannot be perused by the people at large, by making them reach the shop and the hamlet, and converting them from unproductive splendour to useful, though unobserved activity."

Most fully were the expectations of Dr. Birkbeck realized; the Glasgow experiment, therefore, led to the establishment of the London Mechanics' Institution. On the 2nd of December, 1823, the London Mechanics' Institution was organized; and in January, 1824, Dr. Birkbeck, as President, delivered the opening address to many hundreds of workmen, members of the society. I shall not detain you with the history of the rise, progress, and decline of this institution: like others, the moving and guiding spirit being removed, it departed from its original intentions; and notwithstanding the numerous efforts which have been made to revive it, it is with difficulty that the spark is kept alive in the ashes.

From the example of this institution, others were formed over the length and breadth of the land. They progressed most flourishingly for a season; then, the novelty wearing off, the number of members, and, consequently, the funds on which the institutions depended, declined; and the managers—whether wisely or not, who shall decide?—introduced the elements of amusement to attract those whom instruction had failed to

please. Human nature—particularly under the effects of that toil to which, by the necessities of his existence, man is compelled—can enjoy those pleasures which appeal to the senses, when it will weary with those which are directed to engage the mind. As a consequence, it has been found profitable to the treasury of each institution to give a larger share of amusement than of instruction to its members.

So far from offering any objection to the former—no one can advocate more strongly than I do every rational amusement and every healthful recreation. Yea—

> ———Bid the soul of Orpheus sing
> Such notes as, warbled to the string,
> Drew iron tears down Pluto's cheek.

Let us encourage every exercise of the imaginative faculty, and

> "Call up him who left half told
> The story of Cambuscan bold,
> Of Cambale, and of Algarsife,
> And who had Canace to wife,
> That owned the virtuous ring and glass;
> And of the wondrous horse of brass
> On which the Tartar king did ride.
> And if aught else, great bards beside,
> In sage or solemn tunes have sung
> Of tourneys and of trophies hung,
> Of forests and enchantment drear,
> Where more is meant than meets the ear."

Beyond this—let the cheerful man still be cheerful, and exclaim—

> "Haste thee, nymph, and bring with thee
> Jest and youthful jollity;
> Quips and cranks and wanton wiles,
> Nods and becks and wreathed smiles,
> Such as hang on Hebe's cheek,
> And love to live in dimples sleek;
> Sport that wrinkled care derides,
> And Laughter holding both her sides:
> Come and trip it as you go
> On the light fantastic toe."

Each and all of these are as necessary as knowledge to the health and happiness of man and woman; but discretion is required to prevent any competition within the same arena between Minerva and her beautiful sisters.

Unfortunately, this discretion has not been observed; and I now learn from the most successful institutions in England, that

they are compelled to increase the number of their concerts every year—that they must have amusing lectures more frequently, and dramatic readings too, to secure the payment of subscriptions from the members. It would be invidious to name any institutions as examples, but within the past week I have received letters from four institutions in large cities, asking me if I cannot reduce my terms, since they are very poor, and yet compelled to incur the heavy expense of musical entertainments.

A judicious observer has said, when writing of the decline of mechanics' institutions:—

"In the choice of subjects the change has been equally unfavourable; the plain and easily understood discourses on the elements of the sciences, and their application to the useful arts, illustrated by experiments, have been abandoned; and the preference shown for light literature, criticism, music and the drama, has given just occasion for the statement, that even the elder metropolitan mechanics' institution, since its establishment has given more attention to the drama, than to the whole range of physical sciences."

Formerly, courses of lectures were given in regular order; attention was confined to one subject for a sufficient length of time to enable each member of the class to understand at least something of the subject. Now, it is difficult to persuade the managers of an institution to allow you to deliver two lectures in succession; and three is, indeed, a rare stretch of benevolence to the lecturer on science.

Now, let us examine the result of desultory lectures. No subject in science or literature can be treated of in a single lecture so as to convey any permanent knowledge. The pictures that are drawn upon the mind are in fading colours, and rapidly vanish and disappear, if not frequently renewed. Inquire at any of the institutions the result of the system of single lectures,—the reply will be, that after a well-delivered lecture, books on the subject treated of, are taken from the library,—to be exchanged the next week for others on the subject of the last lecture. Thus, we have chemistry, followed by comic recitations or a concert—physics succeeded by phrenology—metaphysics occupying one week, and mesmerism the next—Shakspeare to-day, and spirit-rappings to-morrow—with the occasional diversion of table-turning, and other entertainments. What is the result of all this? A want of fixedness of purpose—an impossibility of concentration in the mind. This desultory practice leads to the loosest habits of thought: out of it—a practice founded upon precisely the same desire as that which actuates a theatrical manager to seize upon every floating novelty—to make the concern pay—has been generated an evil of enormous mag-

nitude,—throughout the length and breadth of the land, habits of superficial thought have become native.

Every one, now-a-days, is expected to talk a certain amount of philosophy—or something which looks like it—Birmingham metal, which, having the appearance of gold, is veritable brass. This table-talk is readily acquired by an attendance on these popular lectures; and, satisfied with this, the young member leaps from subject to subject, gathering here a thought and there a thought, which, since his mind has not been trained in habits of induction, remain a waste heap of materials, actually impeding his progress. To our popular institutions we can clearly trace much of that desire everywhere manifested to appear to know something of the great results of human industry and thought—that homage which ignorance pays to wisdom in assuming her garb and imitating her voice. There is a strange amount of superficial knowledge in the present day; and unless it is checked by the introduction of a more sterling system, we may safely predicate that England will recede in the scale of nations, and lose her proud position of intelligence, and losing her intelligence, of power also.

I do not insist on the alternative of "drinking deep," as Alexander Pope did, yet I cannot but admit that the very "little knowledge" which the young members of our institutions get by attending single lectures, is indeed a "dangerous thing."

A large number of institutions sent delegates to London to meet the Society of Arts, all eager to secure some means by which a better state of things could be brought about; they, one and all, admitted that it was with a struggle they kept themselves alive, and many allowed that their lives were little more than spasmodic convulsions.

There must be a cause for this pause in usefulness which marks the institutions. This cause is the re-action from the mistaken attempts which have been made to amuse as well as to inform. Give the physical man stimulants, and you must constantly increase the dose to satisfy his ever-quickening desire; give the moral man excitement, and to a still greater degree are you compelled to repeat the stirring cause to gratify the want you have created. It is by a series of steps of this kind that the institutions generally have changed their character, and that they have, more or less, suffered. In this way, too, the mechanics' institutions proper have passed away from the artizan and become the property of the higher classes of society, until it is rare to find a true working-man's association. It is a curious fact, and one which should teach us something as to the amount of public ignorance, and the desire of that same public to be wiser, that all the educational publications of the Messrs. Cham-

bers, those of Cassell, Weale, and others, have found purchasers, not amongst the classes for whom they were intended, but those who stood two or three degrees higher in the social scale—and so it has been with the mechanics' institutions.

But let us also observe two or three errors which must be pointed out, as they imperatively demand correction in any new experiment which may be made. Lectures—serial lectures—were in the first instance arranged for working men—mechanics proper. Dr. Birkbeck possessed peculiar facilities: his means of imparting information in the easiest manner, was remarkable. But there were not many Birkbecks; and in the majority of the lectures given too by first-class men, the matter was above the powers of the listeners—the truths were arrows shot over their heads. They wondered at, but could not seize the bright electric flashes. I remember a remarkable example of this. John Stirling—who has been honoured with two biographies, one by Thomas Carlyle, and the other by Archdeacon Hare—and myself, when we were both living at Falmouth, resolved on establishing popular courses of lectures. Having succeeded in obtaining the promises of assistance from some of the most talented men in south-western England, we published a most attractive syllabus, and John Stirling was to give the first lecture, "On the Worth of Knowledge." A crowd attended, and listened to an eloquent and earnest man for nearly two hours, entranced by the glitter and the flashes of truth which appeared to play around them. But, at the conclusion, all declared themselves to be disappointed; they discovered they had been bewildered in metaphysical subtleties; no one remembered any one tangible truth of all that appeared to have been promised. This first lecture was the ruin of the scheme, as far as the working classes were concerned; the key-note was struck too high, and there was but a very lingering response by the artizans to the subsequent notes. For the people, the lectures entirely failed. A select party, friends of the various lecturers, hung together; and, for a year or two, even when poor John Stirling, whose sword was then wearing out the scabbard, had left, we contrived to spend pleasant evenings—but they were not extensively profitable to those for whom they were intended.

On the other hand, care must be taken not to strike too low; and, above all things, to avoid the least appearance of ignorance in the lecturer. I know a remarkable example of the evils of this. In one of the lowest districts of the metropolis, some benevolent hearts resolved to endeavour to effect some good upon the loose population of the neighbourhood. Reading-rooms and refreshments, innocent games and lectures, were attempted, and every effort appeared crowned with success. Men

of ability gave lectures of the most familiar character; these were listened to with attention by as strange a group as ever were gathered together. At last, unfortunately, a volunteer lecture was accepted—the evening came, the room was well filled. The lecturer began his story: he presently halted, stammered, and then got on again—again halted, stammered, and convulsively ventured on some other part of his subject—and so on to the end. Presently there was seen amidst this audience a restlessness—some began to move; and before long, a few girls, an old man or two, and half-a-dozen sleeping children, formed the audience. Now, mark the result. On the following week a lecturer, with whom this audience of London costermongers and beggars was familiar, was to give them a lecture on a very popular subject, and not one of them attended—the room was left to the occupation of the lecturer and two or three friends.

These two examples are applicable to a vast number of institutions, in which the system of volunteer and cheap lectures is the rule. By mistakes of the character named, the working man has been driven from the mechanics' institution; and since, in country towns, some relief to the monotony of every-day life is required, the ladies delight to gather on the benches of the lecture-room, not to learn, but merely to pass away what would otherwise have been an idle hour.

Beyond this—for I must deal with the whole evil ere I propose the cure,—it will have been obvious to all familiar with the subject, that the little jealousies which have given rise to several institutions in the same town—often indeed in small towns—have been the cause of failure in not a few cases. The education return is very instructive on this point, showing the competition as regards the reductions of the members' fees, &c., which exists to the ruin of the good cause.

Many little provincial towns have their literary and scientific institution, exceedingly exclusive—their athenæum a little more popular, offering the attraction of a smoking-room, and putting on the character of a club—their library and reading-room, the London and local journals, and political excitements, keeping up the interest—a mechanics' institution which is not what it professes to be—and sometimes a lecture association which attempts to occupy the ground which the mechanics should have maintained. In these we find the subscriptions varying from the aristocratic guinea a year, to the humble shilling a quarter.

This want of a unity of purpose, this division of money, this division of interests, every way tends to check that progress which might otherwise be made.

How long will it be ere Englishmen will learn to lay aside, as a worn-out garment, those class jealousies which bespeak the

littleness of mind in which they had their birth? The time is past when the eyes of the multitude can be dazzled by the glitter of mere externals. Those manifestations of mental adornment, which alone add true dignity to man, are now required before the people will yield their homage.

It becomes, if possible, of the utmost importance to enlist the older local institutions, many of them having large funds, in the work of improvement which must go forward.

About half a century since those institutions, very commonly distinguished as "philosophical," were in their vigour. They were seldom conspicuous for energy, moving with that stately slowness for which corporation coaches are remarkable, and they surrounded themselves with an imposing barrier of ceremony which effectually kept the people at a distance.

Some of them, however, working under the personal influences of men who have left names "beyond the blight of earthly breath," exhibited activity; and these few, by virtue of that vitality which was infused into their systems, are still pursuing their vocations with credit.

These institutions did their work—in their own way it is true—and satisfied our fathers; but when the heresy of the duty of instructing all classes of society was proclaimed in the tone of command, they fell back from the labour, again wrapped themselves in their prejudices, and sunk gradually into that antiquated repose which is like the sleep of Gineth in the legend of Prince Arthur.

Since the commencement of this nineteenth century, a change has been passing over our moral hemisphere. The world has gradually advanced to a full appreciation of the truth, "Knowledge is power," and that this power is within the grasp of every man. This truth-like sunshine has had to struggle long and often with obstructing clouds, but its light lies now clear and unquestioned on the earth. Upward and onward have struggled the pioneers, and though at first but a humble band, they are now many, and the magnates of the land serve as volunteers in the honoured corps.

Those country or district institutions to which I have been especially alluding, appear to offer so many local centres, about which the smaller institutions should revolve. A multitude of institutions have arisen in this land, through little jealousies, and the desire of power on the part of individuals; we must ask for a little sacrifice of personal feeling for the good of the community. We find in those towns where more than one institution exist, they are literally starving each other, while their union and co-operation would provide a plentiful supply of intellectual food. Instead of being compelled, as they now are, to

engage those who offer them "cheap lectures," which, like most other articles lauded for their cheapness, are of a very inferior quality,—they would thus be enabled to offer that fair remuneration which would induce men of reputation to aid them with the benefit of their knowledge. This amalgamation must be the work of the individual members active in the institutions themselves; and it must be so evident to them that separate exertion cannot result in the good which would spring from combined action, that it appears scarcely necessary to contend for it. In many cases the causes of difference are so small—of a kind so easily put out of view altogether—that it is lamentable to see them in action. Take a few examples. I know one town in which there are two institutions, simply because one party insists on reading the *Weekly Dispatch*, which the other approves not of. Another, where one party wished to see the Saturday papers, when they arrived on the Sunday evening, of which proceeding another portion did not approve. I know yet another town, in which two energetic brothers are working two institutions, simply because they could not agree in their opinion on the election of their members of Parliament; and another in which George Dawson is the bone of contention.

The extent to which class jealousies extend is shown by the fact that in many of our cities and large towns the institutions of the higher classes refuse to engage those lecturers who have delivered lectures at the mechanics' institutions. Now, let all parties endeavour to break through such feelings as those.

I have now indicated a few of the causes which have been constantly at work to the injury of the mechanics' institutions, and I have also endeavoured to indicate a few of the means by which these ichory causes might be removed.

All the institutions have been established under the proclaimed intention of spreading knowledge, and yet we find them immediately yielding to the cry for entertainment. I insist upon it, in the strongest terms which I can employ, that the mechanics' institutions, and the literary and scientific iustitutions of England, are not the places in which light amusements should be encouraged; and it needs no prophet to foresee that the days of those are numbered who have reduced themselves to the condition of departing from their legitimate and right noble path.

Give the people—young and old, rich and poor—poetry and music to the full; and superadd every variety of health-exciting amusement—but find them another arena than that which should be exclusively devoted to the improvement of the mind. I shall be told that the institutions cannot keep open their doors without the amusing evenings. Then one of two courses is before them

dll—shut the doors, or reject literature and science altogether. Let us have no more *shams*. Let our instructions be honest at least, and devote themselves to rational entertainments of the best class, and give up the pretensions of teaching.

I believe, however, that the hard-handed artisans of England will support any institution in which they can really learn. When I have seen the eager attention of 650 working men, night after night listening to lectures on physics, on chemistry, on metallurgy, on geology, on natural history, and on mineralogy, and when I know that 1,500 applications have been made within a few hours to attend those lectures, which have been given by the professors attached to the Government School of Mines, I cannot but believe that a large and influential class are eager to learn, read, and inwardly digest the truths of science and the beauties of literature. Let the experiment be fairly tried, and fear not for the result. Quite certain do I feel that good courses of lectures would pay, since everything is reduced to that wretched standard—and as certain do I feel that the desultory system of lectures now adopted must soon bring all the popular institutions in the country to an end. I cannot but confess that I have failed to persuade the institutions of this—and they are all of them adopting the Micawber system of waiting for something to turn up, by which they may be benefited—instead of seeing how they can help themselves. Hence the cause by which they were induced to rally round the Society of Arts, who offered them something which appeared of promise. But to my main object. I believe the best method of keeping men together is to give them some common interest, and I know of no way by which this can be so effectually done as by the organization in the institutions of classes of observation.

To learn to observe is a necessary introduction to learning to think. There are few good observers—consequently correct thinkers are not numerous; our systems are mainly based on artificial methods. To quote the language of an eminent naturalist—

"The value of natural history, as an educational science, has been but partially recognised in Britain. In our schools and colleges, the chief cultivation has been directed to the nurture and training of the memory, the reasoning powers, and taste: not always by the most judicious methods. Observation, a faculty upon the correct exercise of which the value of the others in a great measure must depend, has been neglected or even entirely ignored. Yet to observe truly, to note accurately, are surely qualities of essential importance to the well-being and future prospects of every youth. The successful progress of a man through life, the weight attached to his statements, must,

in a great measure, depend upon them. The simplest, easiest, and most beneficial method of cultivating the observing powers lies in the acquirement of the methods and practice of the natural-history sciences. Ignorance alone could have excluded them from recognised courses of education. Though partly taught in some of our universities, it is as branches of knowledge usually in connection with the enlightened profession of medicine, and not on account of their value in educational training. Of late, however, there has been a tendency to rectify this. Oxford and Cambridge have recognised, in theory at least, the right of natural history to share in their honours. Their younger sister, London, with the timidity of youth, has hesitated to pronounce in its favour. In the metropolitan colleges, and the universities of Scotland and Ireland, the natural-history sciences are taught by able professors; but the total number of their unprofessional disciples is small, and cannot be said to be increasing. In schools of lesser grades they assume, when professed to be taught at all, the form of intellectual recreations; not that of exercises, and strengtheners of the mind of the pupil. The time, I trust, will yet come when every student will be required to educate his observing powers through the agency of these delightful branches of study.

"The earliest efforts of infant intellect are directed towards the observation of natural objects. Animals, plants, minerals, are collected by the schoolboy, who delights to note their shape and qualities, and rudely to compare and classify. But the thirst for natural knowledge thus early and unmistakeably manifested is rudely quenched by unpalatable draughts of scholastic lore, administered too often by a tasteless pedagogue, who, blind to the indications of a true course of education, thus plainly pointed out by human nature, developing itself according to the laws of its own God-given constitution, prunes and trims, binds and cramps the youthful intellect into traditional and fantastic shapes; even as the gardeners of a past age tortured shrubs and trees into monstrous outlines, vainly fancying to improve their aspect, arresting the growth of the spreading boughs and the budding of the clustering foliage, mistaking an unhealthy formality for beauty. Far be it from me to disparage the educational value of the glorious literature of Greece and Rome, or to withhold due honour from the many able and learned men who give dignity to their profession as educators. To them I would appeal for the rectifying of the evils of a one-sided education. I would implore them, in the name of Aristotle, the greatest of naturalists, and most admirable of observers—how great otherwise none know better than they do—to avail themselves of that science upon which he laid so much stress, and through it to

cultivate those tracts of the mind of youth that now lie fallow and unproductive."

If men will return to the condition of the child, and seek to know the things by which they are surrounded, they may of themselves acquire correct habits of thought. They will then appreciate the lectures which may be delivered in their institutions, and be enabled to discover the true from the false, whenever these are presented.

Taking the county museums, or the museums in large towns, as a nucleus, where they exist, I propose that every institution should add to its stores examples, illustrative of the locality, and of it alone. Much money is spent foolishly in endeavours to form museums of curiosities—Indian arrows, grass hats, strings of shells, and New Zealanders' heads. These from their necessary incompleteness, have little to interest, and still less to instruct. Let the money spent in this way be employed in obtaining specimens of the fauna and of the flora of a well-defined district—collecting examples of its earthy and metalliferous minerals, its geology, and any other objects of local interest which may present themselves. I would propose that this should be effected by the organization of classes of observation in all the existing institutions. The task of these classes should comprehend the collecting of the natural-history specimens common to the locality, and the careful registration of all particulars concerning them—such as the period of the flowering of plants, the appearance of birds in the districts and the commencement of their songs, the migrations of fish on the coast, and the thousand points of interest which cannot fail to present themselves to the careful observer.

Such classes will furnish subjects for every taste; and accordingly the members might volunteer their aid severally in that particular one from which they would derive the greatest pleasure. The following may be named as a few of the divisions:—

Botany,	Entomology,
Zoology,	Mineralogy,
Conchology,	Geology.

Besides these, as sciences of observation, I would impress strongly the necessity of classes for

Meteorological Observations,
Statistical Inquiry, and
Archæological Research.

Each class should meet at stated periods, and every member then report progress. Specimens should be examined and, if possible, named; and the recorded observations should be carefully compared. Every class should have its note-book, and it

would soon be found that a mass of information, of the utmost value, would be obtained. There should be quarterly meetings of all the classes, at which reports should be read, uncertain points should be submitted to general discussion, and unknown specimens referred, by the secretary of the institution, to some acknowledged authority, to be described and named.

From having seen the experiment tried, I can vouch for the enlarged pleasures which every member of such classes of observation will enjoy. Each morning or evening walk is resumed with increased pleasure—the flowers of the hedgerow, or of the brook, are watched with attention, and all nature assumes new and brighter features. The rocks, previously barren of interest, yield treasures—peculiar minerals are found—and strange shapes, telling the story of the progression of life on the earth, attract attention. All things appear to blossom with truths which had previously been passed unnoticed. There is no locality which has not some new facts to tell, and in collecting these each institution will provide the best exercise for the minds of its members, and add something of value to the common store of knowledge. Annual conferences should be held in connection with the Society of Arts: at these, well-digested reports might be made, and these should be afterwards printed and circulated to every institution in the United Kingdom.

To listen to a lecture from a man of ability is good—to read with attention is good—but to observe is infinitely better than either. This system most intimately connects itself with class lectures. The man of science might direct the inquiries of the members of the institutions, and he would himself derive valuable assistance from their labours.

I have advocated such a system as this before, and I shall continue to advocate it. The popular institutions of England are now wasting their powers, and having no restorative element within themselves they necessarily must decline. If we can organize a system of *work* for all—a great industrial scheme—rely upon it good must result. Let us try the experiment.

"Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labour *and to wait.*"

ON FAMILIAR METHODS OF INSTRUCTION IN SCIENCE.

By Robert Hunt, F.R.S.

Since the Great Exhibition of 1851 there has been a determined effort made to introduce science into our schools. This has not been confined to schools of one class, but it has extended equally from the highest to the lowest, from the universities to the national and British schools. It has been contended that every child should know something of science, that is, something of the laws and phenomena of nature. It has also been admitted, at the same time, that the adult portion of the community are in ignorance of these all-important things, and consequently, that means should be devised for teaching science to the man as well as to the child.

It must be remembered that hitherto these branches of knowledge, which are involved in the general class of natural philosophy, have never formed a part of the education of the child, and it has been usually by some accident only that the attention of the man has been directed to the paths of science.

Look at the history of the lives of our great philosophers, and you will find that their progress has usually been a struggle against the prejudices of those by whom they were surrounded. Our leading schools have directed all the efforts of the mind to the study of those great literatures in which are recorded the brightest thoughts which have illuminated the paths over which mankind have moved in their onward progress. But these thoughts have usually been connected with our humanities—a psychological philosophy rather than a natural philosophy. Great truths, however, have been thought out, and here and there we have remarkable evidences of the exercise of a purer inductive

search ere yet the illustrious Bacon had devised his great system of induction.

The finest feelings of our nature—the most important of man's relations to man—are so fully and beautifully shown in those literatures which we especially term classic, that the security of our civilization, with all its blessings, is most closely linked with the cultivation of a knowledge, and a love of and for the poetry and philosophy which is contained in the languages of Greece and Rome.

At the same time, however, as I feel disposed to insist that the disposition to undervalue the systems of education which have hitherto been adopted has a dangerous tendency, I cannot but insist still more strongly that these systems have been sadly defective, because they have not embraced the study of the things by which we are surrounded—the things which we are compelled to employ—without a knowledge of which we cannot obey the command of our Creator, in subduing the earth which is given to us for a heritage.

We are only now awakening to the truth, and I fear that the reaction in favour of a scientific education is likely to lead us into many serious errors; and I conceive that we have an illustration of those errors in the excellent educational exhibition gathered together in this hall.

In its general character this exhibition is essentially practical; it is a great exemplar of the feeling which has grown out of the Great Exhibition,—*that science, in its useful applications to the purposes of life, is the aim and end of education.* I would not for one moment deny the value of practical science as a branch of education, but I must contend that the idea of measuring the value of science by its practical utility is degrading it from the high position it should occupy. Yet this is the characteristic feature of the scientific teaching which will, we have to fear, be adopted.

The value of our knowledge of electricity is estimated by the electric telegraph and the electrotype.

Our knowledge of the phenomena of the solar radiations is determined by the applications to photography.

Magnetism is thought to be worth but little beyond acquainting us with the phenomena of the mariner's compass.

And those wonderful functions of light which we call polarization, are just valued as affording nice indications of the quantity of sugar which exists in a parsnip.

Fail not to remember that science has a far higher and holier end than this: it advances our knowledge of nature and her myriad forms. It teaches us the mysteries which are locked up

in a grain of dust or a drop of water, and unveils to us the wonderful operations of those subtile forces by which the inorganic elements are changed to organic ones, and almost enables us to reach the mystery of life itself.

As it regards the practical value of science, no one can estimate it higher than I do, believing that every truth born to man, however abstract it may be, must, sooner or later, have its practical application. A few examples may not be out of place. [The lecturer here described the applications of Franklinic or machine electricity to the lightning conductor, and the protection of the vineyards of France from hail-storms;—of Voltaic electricity to the electrotype,—and of electro-magnetism to the electric telegraph;—of the phenomena of chemical change, under solar influence, to photography;—and of the polarization of light to the ordinary process of sugar-making and to surveying.]

But [continued the lecturer], let us not train the young mind, like a twig capable of being bent in any direction, to estimate truth by its money value. Let us not aim at inculcating purely mercenary ends as the inducements to our children to seek out the truths of science. If we once yield to this, farewell to all advancement of knowledge. That which is already known may be most usefully applied, but no new truths will dawn upon the darkened horizon within which we shall confine ourselves.

Let us teach our children all that we know of the works of creation, let them learn to comprehend all the great laws which enlarged minds have developed unto us, endeavour to make them understand the evidences of the senses, and to learn to interpret them correctly, but let us not, as a reward, tell them that this knowledge will fetch money in the market. Let us not make them mere hucksters of truth, and regrators of scientific knowledge in the by-ways of humanity. Rather teach them to stand on the hill-tops, and, looking up to heaven and over earth, proclaim aloud the supremacy of man's intelligence, as indicated by our knowledge of a great Creator's works.

I have been for years a teacher of science and its applications, but I have ever been true to the principles which I now contend should guide the teacher, and constantly have I dwelt on those soul-ennobling truths which stimulated the ancient philosophers to laborious thought, and which were the exciting elements in the minds of Newton, of Hunter, of Dalton, of Davy, and of those master minds which still have place amongst living men.

Believing that in the nice, complicated, and delicate apparatus which has been devised and is now exhibiting in this hall, there has been too much leaning in the direction I would avoid, I would venture to impress upon all teachers of the

young not to attempt to teach science in all its details, but to excite curiosity, stimulate inquiry, and quicken the powers of observation. I would teach great phenomena by the most familiar methods, and if I could not make the playthings of the child subservient to my purpose, I would devise the most simple forms of apparatus as my means for illustration. But let me give you some of my own illustrations as examples of my meaning.

The experiments embraced

1.—The impenetrability of matter, shown by a vessel containing air plunged in one containing water.

2.—Pressure of air—shown by water being sustained in an inverted glass covered with a card;—the barometer tube;—the pump, a mere plug of cotton in a glass tube; and the syphon.

3.—Cohesive attraction and molecular force—illustrated by the cohesion of glass discs; capillary attraction and the phenomena of exosmose and endosmose, in all cases the most simple means being adopted.

4.—Motion.—The conservation of the axis of rotation, planetary motion, &c., illustrated by a common humming-top, and a disc spinning upon a rod.

5.—Electricity, as developed by the friction of Indian rubber on paper, the machine or collector being a japanned tea-tray fixed on wine glasses.

Did time permit, examples might be extended to every branch of science. These and similar simple means of illustration should be used to explain those points which it is important every child should know. We usually commence our education by teaching the signs by which ideas are expressed. Now it appears to me equally important to teach ideas at the same time as we teach the signs; and, therefore, I would, in every school, have so much of the sciences taught as would awaken curiosity, produce new ideas, and lead to observation. Every phenomenon thus exemplified should be made to bear on the explanation of the great operations of creation—the wonder, the harmony, and the beauty of all things should be taught. A knowledge of the applications of science is most readily acquired when the facts of science and their bearing on natural phenomena are known.

I have attempted to shadow forth a plan by which every village schoolmaster may, with the means within his reach, *provided he will himself first carefully study the things he teaches*, instruct his pupils in the highest branches of science. Thus, we avoid all the difficulties of supplying expensive apparatus, and the annoyances of seeing it useless when supplied, because the use of the tools is not familiar to the workman.

We give the child, even the youngest child, the means of interesting his fellow-children, and I contend, that by abandoning all idea of confining attention to the market price of the truths taught, and by allowing the young mind to expand itself over the fields of nature "like a wild bird of the wilderness;" to embrace within its flight the whole truth in its illustration of creation's great phenomena, by ascending from practical science to the high poetry of science, we shall produce a nobler being—

"Who shall gaze upon heaven with forehead erect,
And look upon man with a brother's respect."

One who shall rise from material laws to spiritual laws, and from the study of the elements of earth, and of the physical powers by which they are controlled,—to the conception of our Almighty Ruler, great in—

"Intelligence, unity, and power."

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TEACHING THE IDIOT.

By the Rev. Edwin Sidney, A.M.

The training and teaching an idiot appeared till of late so perfectly hopeless, that the idea of its being possible was never entertained; but the experience of the present day has shown that there is no malady incident to human beings which is not capable of some compensation, remedy, or palliative. We can instruct the deaf, the speechless, and the blind, we can sooth and benefit the insane, and we can train and educate the Cretin and the idiot. The great success of Dr. Guggenbühl in freeing the Cretins, at the Abendberg, from the misery of their hideous condition, could not fail to excite to similar benevolent efforts for the benefit of idiots; and they have everywhere been rewarded by the most gratifying fruit of the toil and patience bestowed upon them. In France, in Germany, in America, and in this country, it is now clearly shown by several years of experience, that it is possible not only to relieve, but to improve and teach a large portion of these degraded and contemned brethren of the human family. The class of our fellow creatures to whose amelioration the methods I am about to describe have been directed, are such as have their understandings undeveloped, or developed only partially, and feebly, or who have lost them without becoming insane. It is a subject worthy, indeed, of being included in the list of this distinguished society, because it is now found, by active inquiry, that the numbers of human beings in this degraded bodily and mental condition are fearfully great, and therefore the highest science cannot be more beneficially employed than in casting its certain light upon a question of such importance as their rescue from it, or where that cannot be effected, the stoppage of the process of deterioration, which has never failed, while many are capable of a degree of bodily improvement and mental instruction which cannot be seen with-

out astonishment and pleasure. You will therefore give me your favourable attention while I endeavour to detail to you, in the brief compass of this lecture, the *principles*, *methods*, and *results* of those meritorious labours of which I have for some time been an occasional witness and advocate, and ever with an increasing conviction of their value, both as a Christian duty to these unfortunates of our species, and a study of the mysterious connection of organization and the manifestation of mind.

1. I used the expression *manifestation of mind*, because it is a leading principle of those who are concerned in the education of the idiot, that he does possess in every case a mind similar to men in a normal condition, but that its faculties are obscured or fettered by a defective bodily envelope. So new is the investigation of the subject of idiotcy, that no correct definition of it has yet been agreed upon; but the variety of terms applied to it will be found to be nearly synonymous. The idiot is in truth ἴδιος, as the word implies, solitary, standing *alone*, with a mind so paralyzed by ill organism as to be unable to exhibit in the usual degree, intelligence, will, power, or moral feeling, yet having certain sensations and perceptions. The bodily frame is always in an abnormal condition of health, and without sufficient nervous stimulus to be expended on its various organs, the due share being applied to each one. There is no *standard* of idiotcy, but generally, perception is superficial, thought vacant, fancy frivolous, and bearing eccentric. The grades are of many kinds,—from the imbecile who has speech and some intelligence, yet is unable to take care of himself or manage his own affairs, down to the driveller without power of utterance, will, care, knowledge, capacity, affection, or any proper action. All the varieties are but deviations from this climax of incapacity. "They are," says Dr. Howe, "of all ages, from the child who is entering upon his dark and cheerless pilgrimage of life, without more thought of his relations with man, or his duty to God, than a young animal, up to the old man, who is closing his career without a knowledge of the joys and sorrows of the world which he leaves behind him, and without a thought about his lot in that before him." No one who has not witnessed the various characteristics exhibited by a group, can imagine the extraordinary differences they manifest, all of which have to be considered as influencing the principles upon which the trainer must base his efforts. Some are vociferous, some are silent; there are the moping, the motionless, the restless, and the grinning; some are mild, affectionate, and obedient, while others are wildly influenced by dreadful passions and all kinds of evil propensities; some continually bite their fingers and suck their blood; others dribble; many howl, or loll out the tongue, or

mutter, or are sulky; there will be also seen the dumb, the lame, the epileptic, and not one will be found to meet the necessities of nature normally. Their touch, their feeling, their prehension, their hearing, their perception, are all more or less faulty. Amongst them will be a portion blasted in the bud and gone, with no susceptibility of improvement; they can only be kept from growing worse, and made in a degree comfortable. With such, education is out of the question, but great numbers, as we shall soon see, are not only improveable to an unexpected extent, but actually desire it, and well repay the assiduous pains bestowed upon them. It is also remarkable that, until trial has been made, no one can pronounce what idiots are capable of profiting by education. It can only be said that the cases which are generally the most hopeless, are those attended with paralysis, epilepsy, hemi-plegia, and chorea; but due treatment has in some instances removed or ameliorated these impediments, the experience of which has tended to establish the principles of action. The true principles are also based upon observation of psychological symptoms. Idiots are perceived to have certain wants, tastes, appetites, inclinations, desires, repugnances, fears, and preferences, shown in some way or other peculiar to each individual, and indicating that though fettered, obscured, and disordered by a defective bodily organism, there still exist certain limited sensations, sentiments, and perceptions, which, if rectified, will tend also to rectify their manifestations and emancipate them from their circumscribed condition. If an idiot can distinguish his food, he has some perception; if he shows a longing for things which please him, he has some internal and external sensations; if he can choose between two objects offered him, he has some comparison and judgment; if he yields to gentle persuasion and severity of manner, he has some understanding; if he has any tastes, however limited, there is something occupying the mind. In all these the trainer sees capacities for improvements. His principle is, that these unfortunates not only are endowed with the animal instincts and propensities, but with the feeble germs of those better qualities which are superadded to our physical nature, and which never could occur in the best trained lower animal, even if its perceptive faculties were more acute than theirs. It has been found necessary also to note the degrees of idiotcy, and to include them in the threefold division of the *idiot proper*, *the fool*, and *the simpleton*, each of which requires a peculiar system of management. Each case exhibits its own miserable tangle of the mental reins, which, till unravelled, confuse instead of guiding. I have repeatedly heard Dr. Guggenbühl say, that he received the first impulse to his benevolent and successful efforts amongst the

Crétins, by seeing one of them, of the very lowest grade, kneel daily before the image of some saint, by the road-side. He inferred there must be mind in this poor creature, though he seemed in all other respects mindless, and following out this conviction, he arrived at his present high result. Many idiots have some powers up to the due standard; when one has been discovered, in any instance, it has proved to be the key of the mind. This principle is also established—that it does not follow, that because a human being is unequal to one set of operations, he is so to others. There is a case of an idiot who learned to draw cats with unrivalled skill, in every conceivable attitude, but in all other respects remained an imbecile. Distinctive specialities of the most curious kind are perpetually observable, and have to be noted. The teacher of the idiot has to be made aware that his office differs materially from that of the instructor of the dumb or the blind, where one sense can be substituted for another, inasmuch as here the senses and powers have themselves to be educated. After these have been duly developed, comes their application to the common actions of life—decency, proper habits, attitudes, dressing, eating and drinking, attention, acquirement of knowledge, occupations, handicraft, morals, social affection, and, above all, religion, with its duties and hopes. If the senses, mind, and powers are improved, the results corresponding to each, of activity and intelligence, will necessarily ensue. The task has been most arduous. When the inmates of Park House, the Idiot Asylum at Highgate, were gathered for the first night within its walls, the confusion was so appalling that some quitted the undertaking in despair; but those who persevered, have effected a change that I believe no one could witness without surprise and intense gratification: but I will—not to anticipate the successes to be hereafter described—now beg your kind attention to the methods which have led to them.

2. The first question was—how to begin? The answer was, *with the body*; for an ordinary boy, brought to his schoolmaster, has already his body broke in to the service of his will. Not so the idiot. It is evident that every salutary movement requires the exercise of will and attention, and thus the health of the mental powers is promoted. The plans adopted at the present moment, though very successful on the whole, must, I should premise, be regarded as tentative, since new ideas open before us continually. Every idiot has some bodily defect, and his senses are dormant more or less. He sees without perception, and hears without comprehension. A teacher, therefore, who understands his occupation, will endeavour to quicken the bodily frame by sensorial exercises, the mind by intellectual ones, and blend with them the regimen that will lead to a better health. The

pupil must be received kindly, and every effort made to gain confidence, and draw out attention. A helpless idiot is examined, and it is found that he does not even know that he has limbs. The first object, then, must be to make him sensible that he does possess them, and that he can use them if he tries. One person's time must be, for a while, devoted to a single case. When this person moves, the idiot must be, if possible, made to move in the same way, until he has imitated, by degrees, the common kinds of corporeal movements: and if he can speak, he must be made to name the different parts of the body. In some instances this achievement, where there is promise of amelioration, gives great delight. Only a short time since, I witnessed it in a little boy, who named his limbs and organs of sense with a joy depicted in his countenance as if he had made some great discovery; and to him it was so. When a knowledge of his own frame is thus acquired, and he regards orders and words of command obediently, and not before, he is put into some class of beginners. It is the business of the individual having the charge of such a class to cause those who constitute it to go through all sorts of bodily movements in combination, and it is often a very long time before any further progress can be made. As soon, however, as an idiot is tolerably advanced in this part of his training, he may be introduced into the family to meals, and on other occasions when the household assemble. In time command is gained over the habits which frequently render the pupil so repulsive, but this is only to be achieved by extreme care, vigilance, and the enforcement of a regularity of the strictest kind, by gentle but firm surveillance from morning to night. An idiot has seldom the slightest notion of dressing himself. Here again, at first, some attendant must constantly undertake the same individual. He must make his charge put on one thing right first, and until this is done, he must not proceed to the second; and what perseverance is needed in this particular duty, only those who have known it can conceive. The same may be said of teaching how to wash. After the simpler movements have been taught, recourse is had to gymnastics and drill. The gymnastic apparatus is very simple, from the inclined plane, over which the often-alarmed imbecile is led up and down till he can jump off, with ease, to horizontal ladders, balances, swings, leap-bars, and other contrivances. The difficulties in the way are threefold—where there is a defective muscular power, where there is no effort of will, and where there is some physical defect in the structure of the limbs. It is obvious that a different line must be adopted in each of these cases, and that the last would not afford subjects for a long time, if ever, for the exhibition of muscular energy and drill. Yet many idiots are now to be seen

daily, in the asylums at Highgate and Colchester, moving rapidly by the hands along a horizontal ladder with great glee, who a short time ago were as terrified at being led up a low inclined plane, as any of us, unused to such a position, would be at being conducted to the mast-head of a man-of-war, or round the edge of the outer wall of some lofty tower. To train the eye of an idiot, as well as the muscular system, is a matter of great difficulty. He may see the figure of his teacher in the mass, but it is most probable he does not perceive any part of his person, or its appendages in detail, unless some glittering object, as an eye-glass, a chain, or a seal, catch the eye. But he must be taught to notice, with perception and distinction, particular and minute objects. This is done by laying before him, on a table, a number of geometrical figures cut out of wood; and as the teacher takes up one, the learner is directed to take up a similar one. Another lesson is the holding up the fingers, one by one, and the pupil must hold up the same finger of the same hand. Imitation is a most effectual means of teaching, and is usually regarded under two points of view—*personal*, when referred to the learner's own acts and habits, *impersonal*, when in relation to his actions on substances without. An idiot who is at all capable of the former, mostly makes grimaces. It is obvious, till cured of these, and muscular repose is induced, little can be done, and more than a month has been known to be expended before this condition could be attained: till it is, no profitable exercises of imitation can commence. It is a useful method to take a series of weights, from fourteen pounds to half a pound, and make the pupils select a "large one," or "a small one," "a heavy one," or "a light one," a "solid," or a "hollow" one. When trained to larger objects, recourse may be had to more minute—as for example, cubes of the size of dice, painted different colours. Let the teacher select one, and the pupil one like it. When the teacher places it in any particular position, let the learner do the same. After a time the boy may be brought before a large black board, and the master may draw on it some animal, and notice the effect, and try if he knows one part from another. One of the most improved, and at this time really intelligent inmates of the Essex Hall Asylum, could not for a long time be made to know a dog's head from his tail; he is now an accomplished carpenter and glazier, and his drawings are beautiful. There are two of them now before you, and you will agree that they are deserving of this epithet. When this method has been tried, give the pupil a piece of chalk, and let the teacher make a mark with another, which he must induce him to try and imitate. Thus writing begins. When the large mark on the board is imitated tolerably, the pupil may have a slate, and

when the slate is fairly used, then he may have a book. The same mode may be adopted for reading and drawing. It is almost impossible to teach most idiots the alphabet in the usual way, but the following mode is very successful:—Let a word be chalked on the board, as for example *cat*, and draw the animal. Tell the names of the letters, repeating them, till remembered. To test the recollection, draw and write *rat*, to see if the *a* and *t* are known. In this way all the alphabet may be eventually mastered, on the principle of association. In one case, with which I am acquainted, every mode tried failed; but it was observed that the pupil had a great fondness for bowling. Pins were put up, with the letters carved upon them, and whenever he bowled one down, he was made to name the letter, and at length he mastered all the letters, and is now a fair reader.

Articles of food may be often made to serve the purpose of a speaking lesson, and also one of order. The idiot must sit in the right place, in the right way, and ask or make a motion for the thing he desires to have to eat, before it is given him. The master keeps a few little sweetmeats for the smaller children, and tries to induce them to ask for them properly, and make some token of acknowledgment on receiving one. Thus the slightest things are made subservient to the great object of training.

Domestic employment has a happy effect, not only on the useful training of the idiot, but on educing his mind. Learning certain trades helps the intellect extremely. One boy, considered hopeless in every way, and whom it was found impracticable by any mode tried to teach the alphabet, showed an aptitude for shoemaking—at which he is now a very good workman,—and learned it; and so helpful was this to his mind, that he afterwards acquired both reading and writing with comparative ease. When it is intended to teach an idiot a trade, he is first allowed to go into the shop, and for a long time all he does is to look at another who is working. He is generally left unemployed till he says he thinks he could do the same, and should like to try. Then he commences in earnest, and generally succeeds, pursuing it afterwards heartily.

In the speaking lessons, if the child can speak, he is shown figures of almost every object likely to please him, and the names are asked. When the defect is found, the principal effort is directed to the practice which tends to its correction. Sometimes a poor idiot cannot utter a sound. He is, in this case, made to try and imitate the movements of the mouth the teacher makes in giving utterance; and from simple sounds he advances by slow degrees to a word.

Lessons are given to many idiots, called finger-lessons. A

board is set before them, with carved figures let into it, fitting tight, and those who can, pull them out. They are also practised at lacing stays and boots, and with straps having buckles to fasten round themselves or others, as well as at tying shoes and buttoning clothes. It is curious to see a child, with a strap he knows is to be buckled, and yet he, perhaps, tries for days, and cannot do it; but this once accomplished, a great step is made.

It is the constant experience of all teachers of the idiot—and I have often heard Dr. Guggenbühl express the same of the Cretins,—that religion, and the simple facts and precepts of the sacred Scriptures, make the deepest impression; and that there is granted to them the beneficial compensation of a remarkable facility for understanding them. Indeed, as the poor imbecile advances, if these fail, there is little hope. The mind touched by them is most easily opened to other things.

No pupil of good promise is closely associated with those of bad, either in the dormitories, tables, or classes. The majority of cases have some power, and a tendency towards its exercise. This must be strengthened, and turned in time to other objects.

It is remarkable, that idiots mostly have a love and aptitude for music, which renders teaching them to sing, when sufficiently advanced, more easy than might be at first imagined; there are instances of quite young pupils, true idiots, who can catch and retain an air after hearing it once or twice.

The highest attainments hitherto reached by those who have been successfully conducted through the methods of training I have endeavoured briefly to describe, are capability of writing from dictation, lessons from objects, a fair knowledge of Scripture history, geography to a certain extent, a little grammar, music, general arithmetic, mental arithmetic, trades, and drawing. They are never kept too long at any one thing, and are constantly refreshed by all kinds of out-door exercises, pursuits, and amusements of which they are capable.

Every idiot must be taught obedience by great calmness and yet firmness in the teacher, and by no other means than words, gestures, and looks. Great judgment is needed in this respect, for it is not every person who could train an idiot; and the secret is, never to begin with a command which can be well refused. "He must," it has been well observed, "begin with negative orders, chiefly as not to go there, not to touch that, not to eat this, and by positive orders of which he can compel the execution, and afterwards proceed to those which demand a concurrence of the child's will." When a master has subordinated [illegible] idiot's will to his own, he is in a position to influence him to

act for himself. As soon as resistance to authority ceases, there constantly occurs some spontaneous wish for active and intelligent occupation. Great pains must be taken to make the more capable idiots sensible of the value of improvement, and it is wonderful how they appreciate it, and how anxious they seem for it. One of the most improved idiots I know, being one day called to the speaking lesson said, "Thank you, sir; speech what I want."

I am well aware that what I have here said can only convey a faint idea of the methods pursued, and it is impossible to do more within the limits by which I am necessarily circumscribed. I must proceed to describe, in a brief statement, the successes which have attended the exertions of the teachers of the idiot; and I certainly may say of those whom I have witnessed employed in this benevolent labour, that they possess a tact and a patience beyond any expectations previously formed. It is also surprising to see the consciousness of the idiots themselves in some instances, of their own feeble powers, mingled with a conviction that they shall ultimately improve. One boy, who noticed the evident exhaustion of his instructor as he repeated the same little lesson again and again, said to him, in a tone that was at once touching and amusing, "Wait a little, patience is a virtue;" and in this case patience has indeed been triumphant. Scarcely any conceivable mode has been left untried, and sometimes a strong impression seems to quicken the dormant power by an instantaneous force. Last Christmas a Cretin, up to that time speechless, was suddenly introduced to an illuminated room at the Abendberg, where there was a Christmas tree, and to Dr. Guggenbühl's extreme delight, exclaimed "*baum, baum.*" This vocal utterance was the first gleam of a light which, as he predicted, has gone on brightening ever since. The like result has followed from letters and figures traced with phosphorus on the wall of a darkened room. The same words have been said fifty times a day for a month, and caught at last. When an idiot has been taught to apply the right term to an object, he may learn its uses; if he has learnt to designate a knife, he may be brought to know that it cuts, and to say, "The knife cuts." What has been said, then, will convey to you some idea of the herculean task of training an idiot; but if I at once proceed to describe what many of them who have come under my own observation were, and what they are now, you will, I think, the more readily enter into the new and interesting subject, and rejoice with me in the assurance that what I called at the outset the feeble germs of their intellects, moral sentiments, social affections, and bodily faculties, have not been cherished in vain, and that there is proof of the possibility of

raising most of these pitiable brethren of the human family, who are not below the grade of simpleton, to a condition of improvement both in body and mind, of which no one in former times imagined they could be susceptible.

3. In presenting you with the results of the exertions of the friends and teachers of idiots, I feel it right to repeat that there are still many who are capable of little more than physical improvement and comfort; but there are also many in whom a change has taken place which astonishes all who have seen it. I particularly allude to those two asylums of which that justly esteemed friend of the insane, Dr. Conolly, and their founder Dr. Reed, are the gratuitous secretaries, and to which the latter has devoted himself with a spirit of benevolence only equalled by the talent he has shown for his undertaking from the earliest moment he conceived the great idea. A mother comes in and asks to see her child. The child is immediately brought to her, and she looks earnestly, and asserts with emphasis, "This is not *my* child." "Look again," says the kind matron; she recognises her altered son or daughter, and bursts into tears. Before I make you acquainted with the peculiarities of these changes, I must mention a few of the characteristics of some of the patients. In Essex Hall, out of eighty-one boys now in a different condition, twenty-nine had never uttered an intelligible sound, and twenty-three were scarcely intelligible; forty were filthily degraded, sixty-four were disgusting at their meals, and seventy-two were nearly helpless in dressing themselves and in everything else. Only ten would willingly engage in any exercise or pastime. Out of one hundred and fourteen boys about sixteen are kept apart still, because they are subject to fits. All that can be done for them is to keep them clean and try to make them happy. Yet, of the remaining number, you may find any day on visiting the institution, between sixty and seventy reading more or less, about thirty writing in copy-books, and some of them admirably; more than thirty others write on slates, while sixteen or seventeen draw and copy with great accuracy the subjects supplied to them. There are at least fifty who receive gallery and collective lessons, and as many are practised daily in the speaking classes. Nine or ten actually write well from dictation. A great number, both of boys and girls, are in singing classes, and make, as you would infer from what I have before said, great progress. Quite a little regiment of them is drilled constantly, and the same at Park House, near Highgate, and I am positive that no one could follow them in their evolutions without amazement. More than sixty perform their own toilette in a morning neatly, and a greater number still come in to the prayers of the family, and conduct themselves with great

propriety, while some of them manifest religious feeling and most gratifying reverence. A considerable number go to church every Sunday, and not a few follow the services intelligently to a certain extent, and remember more than you would conceive possible of the text and sermon. The same miserable picture of the poor idiot girls, at their first entrance into the asylum, might be drawn, and the like manifestations of improvement detailed. Both at Essex Hall and Park House the subjects of the charitable solicitude of their managers were equally unpromising, and at both may be shown the great results I am endeavouring to set before you, and which ocular demonstration would convince you I do not exaggerate. There is besides, in the most advanced classes, a constantly improving tone, and symptoms of a prevailing influence inducing them to struggle with their infirmities that they may realize their own progress. It is very striking to see a circle of the pupils under examination in mental arithmetic, in which it is quite perceptible how hard they try to do their best. Nor will it fail to be regarded as a most pleasing fact, that, at Christmas last, twenty boys, whose friends once regarded them as doomed to ignorance and degradation, actually wrote letters home. If you enter either of the establishments I have named about twelve o'clock, you will see cheerful groups of males engaged in various games, but you may perhaps fail to be very much struck because of a prevalent eccentricity of manner, and the remaining stamp of idiotcy still uneffaced. Let them be followed into their dining-room, when the bell rings a little before one o'clock, and mark the kindness with which the strong lead the feeble to their places. At a signal they all stand with the utmost quietude, waiting to sing the grace; and this done, in a manner which is really harmonious, they sit down and conduct themselves with perfect good order. Instead of seizing, as they did at first, the food as it passed along, they hand the plates to each other in the most pleasing way, not exhibiting a symptom of greediness or desire to be served out of turn. The same decorous spectacle presents itself in the girls' dining-room. You would scarcely believe that a large body of idiots were seated at table, such quiet and propriety of conduct mark the whole proceeding, and dinner terminates as it began; with the grace tunefully chanted. Some who were once, to all appearance, thoroughly incapable, lay the cloth, arrange the knives, forks, and plates, and take them away with all the ease and rapidity of practised waiters, and seldom mislay or lose a single article committed to their charge, while their efficient performance of these and other domestic duties renders fewer servants needful. After a certain interval at the conclusion of dinner, occupations are resumed. The gardeners, tailors, mat-

raising most of the makers, rope-makers, shoe-makers, and others, are not below the to work, and take a just pride in their ment both in body afts, and are delighted to be asked to show imagined they couhey have done. The girls go to domestic em-

3. In presentingnitting, sewing, or fancy work, bonnet-making, friends and teaches are also formed for writing, speaking lessons, there are still many, and other profitable instruction. Many improvement and mats have been sold within the last year, and change has tabnly to be good in appearance but to wear extremely I particularly often passed the most improved through their va- esteemed fri es, and have examined them in object lessons, the Reed, ares, arithmetic, and geography, so I can testify to the devoteddvances they have made. Only a week or two since I was talentmpanied by a clergyman, who questioned them in my pre- mence in the simple outline of Scripture history, and the precepts tof our Lord, and he expressed the greatest pleasure and surprise at the answers given, declaring he should have thought such pro- ficiency impossible had he not witnessed it. Once a week, at Park House, Highgate, there is a sort of concert, at which several male and female pupils, arranged on different sides of a piano-forte, acquit themselves with great credit, and manifest the highest enjoyment. Some of the boys also play with accu- racy and good expression on the harmonicon, and it is very amusing to hear them accompanied by an excellent performer on the violin the establishment fortunately numbers amongst the teachers. Visitors occasionally seem to doubt whether they are really amidst idiots, forgetting the many powers that are in- cluded in, and may be elicited from, those called by this forbidding name; for idiotcy is as variable as the possible combinations in the actions of the unnumbered functions of the human brain.

I will endeavour further to illustrate my subject by the his- tory of a few individuals. A boy was admitted in November, 1850, and brought the following character from his parents:— "He is turbulent, has no memory, is unteachable, but swears dreadfully." The character he bears at this moment is that he is "quiet, can read, teaches others, sings well, and never utters a bad word." Another, received as a pupil in the same year, was represented as not possessing the least power of imitation; but he has nevertheless learned to read, to write, to sing, and to net. A boy I am frequently in the habit of noticing was pro- nounced hopeless, could never be taught a letter even by his father, who was a schoolmaster, was always chattering the most repulsive rubbish, was obstinate, and very passionate and vicious, resisting with fury when first taken into the asylum. At this time he can read, speaks with propriety, is civil, kind, and generous, dividing with the young pupils any sweetmeats or

fruits that may be given him, is useful in the house, and a really superior shoemaker, finishing his work in a most creditable way. A youth who attracts the attention of every visitor from his graceful carriage and superior manners, could, when he came under tuition, neither read nor write, was unsociable, passionate, and obstinate, besides being deaf and nearly dumb, so that apparently he had not any sense of a single thing. He is now the fugleman of the drill, reads fairly, draws beautifully, sets copies for the writing lessons, is very attentive, has nice manners, has become an excellent carpenter, and has made a good model of a ship, can glaze the windows of the house, has improved in speech, takes the lead in all manly exercises, and, more still, I believe him to be sincerely and deeply religious. A powerful idiot, in bodily frame, came to one of the institutions as lately as May, 1853, and his age is eighteen. He proved to be altogether beyond the control of his afflicted mother, and in two instances had nearly succeeded in taking her life. Altogether he was given to mischief, and, if excited, would destroy whatever came in his way. It had been found, nevertheless, possible to teach him to read and write a little; but he would never work, and no reliance could be placed on anything he said. He has been frequently before me, and I can assure you, that though some degree of excitability still remains in his constitution, it is soon subdued by gentleness and firmness, and he is generally obedient and agreeably playful. He reads and writes well, and understands the elementary rules of arithmetic, showing also a surprising quickness in mental calculation. There is reason to believe he will soon draw accurately, and he is one of the best mat-makers, applying himself to this work with the most persevering industry. His mother visited him during the present year, and was perfectly startled, as well as moved to expressions of tearful joy, at the complete metamorphosis she witnessed in her son. It is not easy to imagine a more repulsive human being than the next to whom I shall advert. His head rolled distressingly, his barking was horrible, and he appeared senseless and indifferent. At the present time he is lively and happy, helps to clean the shoes, is musical, and what is more, can be depended on. Amongst the happy examples of great amelioration, there is a boy whose language was most imperfect in every thing but awful swearing; and he was also deceitful and would do nothing. He can repeat any sentence distinctly, never uses improper terms; he reads, writes, draws, and sings, is a fair tailor, and so truthful that he would not tell an untruth to conceal any fault. In May, 1851, a youth came in who was said to know nothing, and seemed without power to do anything; he ran away several times from home, and for eighteen months

after entrance appeared unimproveable. He now knows the alphabet, can write, makes shoes, and is obedient. A boy, received in December, 1850, was listless, inactive, unintelligible, solitary, filthy, gluttonous, and a liar, He has become active, is good at drill, sings well, writes from dictation, draws fairly, is clean, and his bad habits are quite gone. To show what may be done with the most hopeless cases, I may mention another boy, admitted January, 1850. He was violent, required constant watching, was destructive, lied, stole, could not dress, and knew no letters, but comprehended things said to him. At present he is mild, well-behaved though eccentric, can dress, reads, writes, plaits, drills well, and plays the harmonicon. There are many who could testify that I have not overdrawn any one of these examples; and the same instances of success have occurred amongst the girls, of which, with your permission, I will mention a few. One who came in October, 1849, was an actual hindrance when she tried to help, could not be left an instant, and was seemingly without an idea. She is now a real help, arranges things well, sweeps, dusts, and scrubs effectually, and begins to assume a cheerful, intelligent aspect. There are several others who were nearly similar in imbecility, and who have made equal progress. A girl was received November, 1851, who was unwieldily stout, was self-willed, given to abominable language, and screamed so loud that she was heard a quarter of a mile from the building, and behaved so ill, that they could not have her at the family prayers. She is improved in her figure, can walk and even run, assists in nursing the little patients, is affectionate, well-mannered, and tractable, has ceased to cry loudly, and is decorous at worship. A girl also entered November, 1851, who had never spoken, and was supposed to have no power of speech. She can now recite verses, is correct in language, and is perfect in articulation. Another who came under instruction in May, 1850, did not know her own name, and could only say *yes* or *no*, and seemed unable to perform any act except threading a needle, which she was without sense to use. Her speech is improved, but curiously enough, though I constantly ask her, she cannot tell me her own name, though she knows the names of all the inmates in the house. She is clever at making straw bonnets, and proves very useful in the daily domestic work. A girl who, on her reception in 1851, was inactive, spiteful, and sly, has become active and full of glee, runs about the place on any errand, makes the beds, and is very affectionate, but still retains a degree of eccentricity. I could go on enumerating many equally striking cases, but will allow myself only one more, that of a young female who entered July, 1850. She had been the source of extreme pain and anxiety to her parents, was troublesome,

dirty, mischievous, and a great pilferer and story-teller. She, however, knew a few letters, and could sew, but very badly. Now she reads, writes, and is good at her needle. She plaits, does bead-work, knits, is skilful at fancy-work, besides being improved in speech, and having become cleanly and trustworthy. In adverting to these improved pupils, I have more than once told you of the surprise of the parents who have visited their children, but I have reserved till the present moment the mention of one instance that is really, could it not be vouched for, almost incredible. A father and mother called at Essex Hall, only a short time ago, to see their son, and, at their own request, went into the room where he was employed with several other pupils. They both said he was not there, after what they regarded as a sufficient scrutiny; and when they discovered him, the father could only utter, in a voice choked with emotion, "My heart is full, I cannot tell you what I feel." He saw his son rescued from the dreadful slough of brutishness, made tidy, decent, industrious, and happy, and no wonder he was thus affected by the spectacle; and when to this is added, as is the case with some of these pitiable creatures, a knowledge of scriptural truth, of their Saviour, religious impression, hope of future felicity, and desire for prayer, the triumph of the philanthropist is complete..

The advancements made in the teaching of idiots, will not be without great practical use in teaching others, and bring to the mind many things of importance that have been overlooked. It will especially throw light on bodily training, as a valuable agent in eliciting the mental and moral powers, though it has too frequently been regarded merely as promotive of muscular strength and manual dexterity. Corporeal exercises in children need not be only idle amusements and useless pastimes—they may be made of more service, both for the intellect and the organism, than ill-considered tasks and injudicious lessons. The idiots I am acquainted with could not for a long time be taught to play cricket; but they have, some of them, now conquered that game, and have been invited to play in the grounds of kind gentlemen residing near the asylum, and have thus been brought into contact with intelligent people, have manifested gratitude and excellent conduct, and the consequent improvement in their tone and deportment is very great. Any frequent call upon volition and attention in bodily exertion, gives tone and vigour to the system, not only increasing the power of the muscles, but inducing sound sleep, which ministers to the improvement of the mind, and leading to the power of continuous attention, which requires mental effort, and cannot be completely given but as the mind itself improves.

This country, ever ready to adopt and encourage whatever is shown to be for the good of the human species, will soon see the training of the idiot carried out in a large model erection at Redhill, near Reigate, the foundation-stone of which was laid June 16, 1853, by your illustrious and enlightened president, His Royal Highness Prince Albert. The knowledge of the existence of thousands of hitherto ignored brethren of the human family, shut out from the world by this appalling malady, will awaken even a larger sympathy than now exists. The proofs that they are capable of being instructed will arouse the generous spirit of the nation, and they will be rescued from home confinement, and the companionship of the insane, and taught the profitable lessons now given to the favoured few in our idiot asylums. I could show you several idiots instructed in love to God, duty to man, and profitable acquirements, who were once chained up as if they had been wild beasts, till the same spirit which caused Dr. Conolly to bury the fetters of the lunatic, unlocked the bonds of the idiot, and taught the great truth by the results of patient training, that the preconceived sterility of any field for good is no barrier to the success of a labour of true benevolence. But the great difficulty will be to find teachers; not only teachers *trained*, but teachers *born*, full of the enthusiasm of a noble spirit, love for the objects of their care, zeal for their laborious work, patience which years of perseverance cannot quench, earnestness of manner, imperturbable temper, unbounded fertility of invention, and complete faith in the ultimate issue of their endeavours. This conviction will be assured by contemplating what has been already achieved; and which, in concluding, I can sum up in a few words. I can say of the idiots which have come under my own observation, that *all* are more or less improved in personal appearance, quietude, health, and contentment; *most* are improved in vigour, decency, self-control, perception, speech, knowledge of objects, and what is a very happy circumstance, have ceased from disgusting dribbling; *many* are improved in powers of all kinds—observation, manners, thoughts, habits, pursuits, and religion; *some* are so renovated that they may mingle with educated persons, and with a little superintendence may pass fairly through the world, and earn their own livelihood. I am thankful to have been permitted to address the present audience on this matter, and that your society has included the work of the reclaimed imbeciles in its instructive exhibition. A wise and beneficent Creator has not permitted the existence of human beings with veiled powers without some design for them and for us. The removal of this veil may be a part of our probation; and if it is the Creator's wisdom that there are idiots born, it has now been clearly manifested that it

will be our sin if those who are capable of being taught die in this condition. These successful attempts to awaken faculties hitherto dormant, and to restore lost minds to themselves and to God, are worthy of our nation, and are a fine example of the true practical genius of Christianity, while we see in the remarkable capability of the idiot for comprehending its simple precepts, and enjoying its promises, a confirmation of one of the most touching sayings of its divine author and teacher, "Blessed are the poor in spirit, for theirs is the kingdom of heaven;" and the reflection on it will tend to make poverty of spirit, and feebleness of body, appeal to our hearts, that we may help those thus afflicted, shorn of the wings of intelligence, crippled in power, and lagging far behind in the race of progress, to the best place we can give them in the present life, and the high consolation of the hopes of that which is to come.

ON TEACHING THE DEAF AND DUMB.

By Dr. W. R. Scott, *of the Institution for the Deaf and Dumb, Exeter.*

The schoolmasters of every man are many and of various kinds. From the moment we enter into the nurse's arms to the time when we sink again into second childhood, we are ever being influenced by the circumstances into which we are thrown. Society is to the human being what soil and climate are for plants. It cannot change his nature, but it may so modify it that he may become as stunted as the diminutive vegetation that clothes the polar zones, or may flourish in more genial climes as to display all the strength and beauty of the forest oaks of our own country.

The great distinguishing feature of man is language. Deprived of the power of communicating and recording his ideas, and of receiving the ideas of others, he never could have advanced beyond the boundaries of his own limited experience. That experience also must have remained crude and unsatisfactory, for it never could have been corrected by the purifying process of passing through the minds of others. Without the means of communicating his thoughts, man must have roamed on the earth a solitary savage, with no power to develop those instincts of his nature which prompt him to become the being of social and civilized life. There might have existed in his soul the fountains of love, hope, and joy, but he never could have mingled these feelings with those of his race; he might have possessed a soul capable of admiring the beauties of nature, but he never could have sympathised in such emotions with others. His feelings must all have remained isolated within himself—never advancing beyond their original prison-house. How infinitely great, then, are the benefits which the power of communicating his ideas confers on man—all his mighty gifts of intellect would have been but a painful burden on his existence, had not

language, or the means of communion with his fellow-creatures, been the crowning gift of his benevolent Creator.

There are few surer tests of the extent to which a people have become civilized, than those of the power and accuracy of their language; and there are no more prominent accompaniments of barbarism than feebleness and poverty of expression. As a people extend their acquaintance into the mysteries of nature, new forms of speech are required; and as the operations of thought become more refined and more subtle, it follows, as a necessary consequence, that their expressions of thought partake of a similar accuracy and precision.

"To be without language," remarks Dr. Brown, "spoken or written, is almost to be without thought. We must not think, in a speculative comparison of this sort, of mere savage life; for the rudest savages would be as much superior to a race of beings without speech, as the most civilized nations at this moment are compared with the half-brutal wanderers of forests and deserts, whose ferocious ignorance seems to know little more than how to destroy and be destroyed.

"In our social intercourse, language constitutes the chief delight—giving happiness to hours, the wearying heaviness of which must otherwise have rendered existence an insupportable burden. In its more important character, as fixed in the imperishable records which are transmitted in uninterrupted progression from that generation which passes away to the generation which succeeds, it gives to the individual man the product of all the creative energies of mankind, extending even to the humblest intellect, which can still mix itself with the illustrious dead, that privilege which has been poetically allotted to the immortality of genius, of being 'the citizen of every country, and the contemporary of every age.'"

It is only when the full advantages of accurate language are understood, that we are fully prepared to comprehend the calamity of its absence. No race of people probably exists where such a power is not developed.

But amongst the various diseases to which mankind are subject, there is found one which places its unhappy victims in the condition we have contemplated. It is that of deafness from birth. With the advancement of scientific knowledge, diseases have generally been found, under divine favour, to give way more and more before the skill and assiduity of the physician; but in the case of deafness, little has been done.

Few realise to themselves the true position of the deaf mute. Some have ranked him amongst the idiotic and insane; others have considered him endowed with supernatural powers; and as he presents to the eye no apparent difference to ordinary

persons, many believe that no peculiarities are attached to his condition.

One cause which so long retarded the instruction of the deaf and dumb, was this prevailing ignorance of their true state. All people who did not speak were considered in common, and classed as imbecile persons, and were left without any attempt at improvement.

A closer observation, however, led to a better classification, and instead of finding that all dumb people were alike, they were found to be divisible into *three* great classes, the dumbness in each arising from a very different cause. Those dumb from deafness forming one class, those who could not articulate because of imperfect vocal organs another, the third class being those who were dumb from mental weakness.*

Now, it is the first of these classes to which our attention will be confined to-day, and it is composed of those persons who have been denominated *deaf-mutes*.

Those who have given but a limited attention to mental philosophy will readily perceive that deaf-mutes do not form any *distinct class* in their natural intellectual constitution. The difference they present is one wholly attributable to their seclusion

* *In the census of Ireland*, 1851—*Report on the status of disease*—the following results in connection with the deaf and dumb appear :—Total, 4,485 ; of those, 334 were dumb and not deaf ; there were classed into dumb only, 131 ; paralytic dumb, 45 ; idiotic dumb, 115 ; and those both paralytic and idiotic, 43. The proportion of deaf and dumb in Ireland to its inhabitants being 1 in 1,380.

The census of Great Britain, which we have not yet had an opportunity of examining carefully, shows the following results :—Number in Great Britain, 12,553 (6,884 males, and 5,669 females). The proportion in England is 1 in every 1,738 persons, and in Scotland 1 in 1,340, and in the islands 1 in 1,704. The largest numbers are in the agricultural districts, especially where the country is hilly. The highest average is found in the northern counties of Scotland, the proportion there being 1 in 1,156. In the south-west of England the proportion is 1 in 1,393 ; south of Scotland, 1 in 1,484 ; Wales, 1 in 1,542. The highest proportions exist between five and twenty-five years of age, the numbers gradually diminishing as the age advances. The most painful part of the whole, however, is, that out of the 12,553, the greatest proportion of them being between the ages of five and twenty-five, *only* 1,100 *are returned as inmates of institutions*. We trust these returns may lead to the important result of the deaf and dumb being more generally brought under instruction. The institutions founded are by no means overfilled, and if parish authorities would only avail themselves of the permission which the poor law gives them to pay the small fees usually required by such institutions, and send the deaf and dumb poor throughout their districts to such places, the next census might give us a much more happy account of the condition of this unfortunate class.

from social intercourse; and however, after a time, this deprivation may alter the formation and development of their character, still, by nature, they are endowed with feelings, sentiments, and passions, common to the rest of mankind; while amongst themselves there is found all the variety of intellectual and moral character which is presented to us by others. Any modification, therefore, which is shown in their mental powers must find its cause in the want of social intercourse, and the absence of that anxious training of early childhood which parental affection always provides when communication between parent and child is complete.

Those of mankind who are endowed with hearing and speech, and have free communication with their fellow-men, more or less educate themselves, and long before they have arrived at mature age they will have made an extensive acquaintance with many of the most useful facts of nature. Take as an example of the value of early acquirements, the instance of language, how perfectly and how extensively do even children become acquainted with this; not certainly with its principles, but, what is of far more importance, its practice. Few, indeed, sufficiently estimate the importance of this early acquirement, which those possessing the faculties of hearing and speech drink in, as it were, with the nutriment of childhood. But when we see the labour and difficulty with which it is acquired, when it has to be taught by a kind of artificial means, as in the case of the deaf and dumb, we can then estimate more truly the value of what we have obtained, and feel how easily we have obtained it. We can then, too, estimate better the amount of useful knowledge, the historical facts, the moral truths, and the varied information which we have received from the conversations of social life, and feel how much we owe to being one of an intelligent community.

It is only by such reflections that the true position of the deaf-mute can be fully appreciated, and it is only after arriving at such knowledge that he can be provided with such instruction as is best fitted for his condition, that most likely to overcome the evils contingent on his calamity, and place him in free communication with that society in the midst of which he stands isolated and alone.

It will be at once apparent, then, that *direct teaching or school instruction* is far more imperatively demanded for the deaf-mute than for ordinary cases. It has been shown how much those with all their faculties may and do receive from their mere social position. But even these, it is felt, require all the aids and appliances which ingenuity and perseverance can invent, to give to the mind all the advantages required to strengthen, develop, and habituate its faculties to the pursuit of objects best fitted for its

happiness here and hereafter. Of this truth, this great Exhibition is a proof as well as a noble example of the earnest thought and laborious industry now being devoted to such a cause.

Left without direct teaching, the deaf-mute is not only denied a knowledge of the higher and more recondite truths of nature, but he is shut out from the commonest courtesies and humblest solaces of life. It is true that he forms opinions and reasons on what he sees around him, yet in both these he frequently makes great mistakes and forms most erroneous notions.

The deaf and dumb do not, however, remain in their isolated position without a struggle to enter into communication with their friends, and, to some extent, they succeed.

Speech, the usual means of communication in social intercourse, is denied to them. They have, therefore, recourse to a language which exists independent of all conventional arrangements, and which is addressed, not to the ear, but to the EYE. A language of *gesture*, designated by teachers of the deaf and dumb the *language of signs*. This language is found to be as universal as the feelings which are the distinguishing features of humanity itself, and it opens a way by which we can exchange our thoughts with the deaf and dumb, and becomes the great ground-work of all their instruction.

Having indicated the condition of those who are born deaf and dumb, before instruction, let us now consider what their case demands, so that they may be brought within the pale of society, and made useful members of the commonwealth.

The first object must be, to place them in communication with their fellow-men; and to do this, they must be given a knowledge of the language of their country. Language then, *spoken* or *written*, must form the first great object in our teaching.

It has been mentioned that, from his earliest years, the deaf-mute attempts by gestures to communicate with his friends, and does by such means make his commonest wants and necessities understood. Here, then, in this language of *gesticulation* is found a starting-point common to teacher and pupil, and upon the perfecting this means of intercourse rests the power of giving intellectual and moral freedom to the deaf and dumb. In the annals of Roman History, we learn that the power of gesticulation, or pantomime, was carried amongst that people to great perfection; but it remained for the holier influences of a Christian age to apply so useful an art to the amelioration of a painful affliction: and that which was only consecrated by the ancients to mere frivolous pleasures, has become with us an instrument of blessing. Perhaps it may not be uninteresting to notice here a few of the earlier attempts at deaf-mute instruction. The pioneers in the art chiefly devoted their energies to make

the deaf and dumb articulate, in the belief that written language could not be learned without *sound*, or speech being associated with it.

The first notice we have of a deaf person being instructed occurs in Bede's "Historie of the Church of England," published 733. There we are told that Bishop John, of Hexham, had "cured a deaf and dumb man by blessing him." But the bishop, as well as making him put out his tongue and making the sign of the cross upon it, "added certain letters by name, and bid him say A, and he said A; and B, and he said B. And when he had said these, he put him into sillables and whole words to be pronounced, and then commanded him to speak long sentences, and so he did; and ceased not all day and night following, so long as he could hold up his head for sleepe." Here, then, appears to be a case of deaf-mute instruction, in articulation, more or less successful, as early as the year 690.

John Bulwer, in the year 1648, also "exhibited the philosophical verity of that subtil art, which may inable one with an *observant eie* to *heare* what any man speaks by moving of his lips, proving that a man born *deaf* may *heare* the sound of words with his eie."

John Wallis, a professor of mathematics, at Oxford, about the middle of the seventeenth century, also wrote on teaching articulation; but by far the best work that has ever appeared on the subject of teaching speech is Conrad Amman's, "*De Loquela*," published at Amsterdam, A.D. 1700. Boerhave says of Amman, that "so minutely had he inquired into the structure and action of the organs of speech, that if his life had been longer spared, he would have explained the physical causes of the various kinds of voice in other animals."

While at a recent meeting at Chevalier Bunsen's, convened for the purpose of considering the important question, whether or not a uniform system of expressing foreign alphabets by Roman characters could be devised and agreed upon, Professor Owen characterizes this work of Amman's as "exhausting the subject of speech so far as its physiological causes are concerned."

Wallis, however, as well as writing on articulation, had more extended notions on teaching the deaf-mute; for we find in his letter to the Honorable R. Boyle, published in the Transactions of the Royal Society, 1670, that he made use in his instruction "of such actions and gestures as have a natural signification." He also showed that letters or writing might be at once associated with our conceptions, without the intervention of sounds, a principle which forms the fundamental idea in the school of De l' Epée, and modern teachers, though the same truth had

indeed been anticipated by the Italian philosopher, Jerome Cardan.

Pedro Ponce, a Spanish monk, who lived in the middle of the sixteenth century, taught two sons of a Castilian nobleman, and with such success—if we may believe the accounts handed down to us—as has not been surpassed by modern efforts. Recent researches have shown that both in England and in many parts of the continent, various attempts were made to instruct the deaf and dumb, from the sixteenth to the eighteenth century; but it was not until the benevolent Abbé De l' Epée founded in Paris an institution for their instruction, that the art of teaching the deaf and dumb assumed an important office, and was reduced somewhat to systematic principles.

Having seen the condition of the uneducated deaf-mute, and glanced at the earlier attempts to ameliorate that condition, we may next consider more in detail the aids now employed in his instruction. These aids may be said to consist of:—

Firstly—Signs, or gestural language, with which may be classed pictures, models, and illustrations of various kinds.

Secondly—Dactylology, or spelling on the fingers.

Thirdly—Articulation, which may be divided into lip-reading and speaking; and

Fourthly—Writing and reading.

Different teachers have estimated these aids at different degrees of importance, but all are more or less employed. There may be said to be at the present time three distinct systems or modes of teaching deaf-mutes, namely, the *French*, the *German*, and the *English*. The French system has chiefly made use of signs, which it has developed to a wide extent into what has been termed *methodical* signs, but it has paid little or no attention to articulation.

The German system, on the contrary, uses speech as the principal means of imparting instruction, and endeavours to make all its pupils articulate like those who hear. It forbids the use of signs as far as possible, and uses as little as may be the manual alphabet. It attempts to change the deaf-mute into a speaking and, apparently, a hearing person.

The English system adopts an intermediate course between the German and the French. Like the latter, it employs signs as the great means of imparting instruction, but confines itself more to natural signs, and has used but sparingly those methodical additions adopted by the French. It uses, like the Germans, articulation, though in many of the British schools this has been abandoned as impracticable, when extended over a number of pupils. But it is still taught to such pupils as indicate an aptitude for its acquirement.

The American schools have not been alluded to, as they have professedly followed the French system; though, of late years, they have appeared to approach nearer to the eclecticism of the English. No nation has done more than America for the cause of the deaf-mute; and no nation stands higher in the efficiency of its teachers, and the provisions made for the deaf and dumb.

We shall next examine more at length the nature of this language of gesture.

The *language of signs*, as understood by teachers of the deaf and dumb, is that mode of gestural expression through which they first hold communication with their pupils, before any knowledge of written language has been acquired.

If spoken language is to be considered an invention, and not the direct gift of the Almighty, then sign language was probably the primitive and the natural means of human communication. Dr. Reid remarks that "if mankind had not a natural language they could never have invented an artificial one, for all artificial language supposes some compact or agreement to affix a certain meaning to certain signs; therefore, there must be compacts or agreements before the use of artificial signs, but there can be no compact or agreement without signs or without language, and, therefore, there must be a natural language before any artificial language could be invented." It is probable, then, that this primitive natural language was one chiefly of gestural expression, such as has here been designated a language of signs.

This language, however, as now used in the school-room, does not confine itself to what may be considered natural signs. It has been so extended as to embrace a large number of signs as artificial as written language itself. So that it is, as now employed by the teachers, of a mixed character, and requires some discrimination in its use.

Sign language, in its natural character, does not afford the means of that elegant variety, or of those nice differences of expression, allowed by the extended phraseology of a cultivated language. It may rather be compared to some of those languages of uncultivated nations which, we are told, "have but one sound to signify *joyful, joy*, and to *rejoice*, and that through all moods and tenses; the mere radical ideas are set down together, the connecting links must be guessed at." In bringing this language of natural signs to bear upon one which is cultivated and refined, we feel desirous of engrafting upon these natural roots such artificial additions as would help to give to this language more of the copiousness and accuracy found in the fulness of polished speech. Hence this language, as now employed in the school-room, consists of both natural and artificial signs.

Natural signs are, however, by far the most important, and

the only ones by which we can convey *ideas* to the mind of the pupil. These signs are capable of a twofold division, viz. into those *truly natural* and those *descriptive* or *imitative*.

Purely *natural* signs are not a very extensive class. They are common to all mankind, are instinctively made, and instinctively interpreted. They are so associated with the mental faculties, that the signs become the certain indices of the internal state, and in fact are to be ranked amongst the involuntary, rather than the voluntary acts. They are the result of the relation established by nature between the mental emotions and the different bodily organs, every distinct emotion having its peculiar effect upon the muscular system. Every person is aware of the bodily expressions of *fear, love, joy,* &c., and it is impossible to confound the gestural expressions of either with those of *courage, hatred,* or *sorrow*. The haughty step, the erect carriage and disdainful look are sure indications of pride, while in the trembling limbs and timid gait fear is ever too painfully visible. The merest infant can interpret a mother's smile or a mother's frown, and it is upon this instinctive method of communication, independent of all conventional agreement, that we begin to build our ORGANON of deaf-mute instruction. To limit natural signs to this class only, would be a rigorous definition, and, were we solely to confine ourselves to the use of such signs, we should shut out a large class of the utmost importance in the work of instruction—a class comprehending signs which, though they cannot strictly be termed *natural,* may yet by a little extension of the term be ranked under this category.

These signs are such as persons ignorant of a common language would at once have recourse to, in their communication with each other. They are not inappropriately termed *descriptive* or *imitative* signs, and hold a very important office in the education of the deaf and dumb. They comprehend the various gestures and movements of the body and its parts, imitative of the different actions employed by man in his various operations of necessity or duty. They also extend to descriptions of the actions and habits characteristic of different animals, as well as to the pointing out of the peculiarities of inanimate objects. Thus our signs for eating, drinking, ploughing, reaping, &c., are actions imitative of these operations; our signs descriptive of flying, running, &c., are of the same class, and when these are associated with signs indicative of the operator, combined with any other particulars that may be necessary, we are enabled to tell a little story more or less graphically, according as the relator may be more or less observant and expressive in his signs. Pointing to the coals, then to the fire, and imitating the act of throwing the former on the latter, would readily be understood

to imply that we wished the fire to be replenished with fuel. These signs would all be readily responded to by an uninstructed deaf-mute, if he had previously possessed opportunities of witnessing the realities which they were intended to represent. It will at once be apparent to what a large extent this class of signs is available, and, though they may not philosophically be considered natural signs, yet for all the practical purposes of the school-room they are so. In using these signs it is not uncommon for different individuals to vary to a certain extent their descriptions of the same thing, from the fact that different peculiarities may impress themselves with different prominency upon the mind of each; so that, in describing a bird, one may have been impressed most by its bill, another by its feathers, and another by its wings; while, in an elephant, one may dwell on the length of its trunk, another on its tusks, and another on the peculiarity of its gait; and yet these differences are never so great as to produce misunderstanding, or practically to interfere with the value of the signs themselves as a means of instruction.

So far, then, we proceed upon a language which is natural, and therefore self-interpreting to our pupils. It is a language which has always peculiar attractions for the deaf and dumb, and one in which they are all more or less eloquent.

So rapid are the mental processes beyond the means of communicating our ideas, that a continual tendency is produced to express our thoughts in the most abbreviated form compatible with being understood. This principle is felt in spoken language, and it operates upon the signs which we are now considering; for we frequently find, when our communications with our pupils have extended over some time, that the full natural signs are often so abbreviated as merely to be indicated by slight motions of the hand or head—the roots indeed not unfrequently being lost sight of altogether in these abridged forms of expression. When such a habit is indulged in, the process becomes one of mere arbitrary forms, and is comprehensible only amongst ourselves. If the ideas have first been imparted by the full signs, the custom of afterwards using the abbreviated forms may not be so reprehensible; but when they are employed to convey first ideas to young pupils, the only connection that will be taught will be between the word and the sign; the idea itself will not appear in the association in the mind of the pupil, however it may have a place in our own.

In entering upon a consideration of the next class of signs, we have to deal with one very different from that already discussed. We have now to examine those signs which are *conventional*, and which, to be understood, must have a meaning affixed to

them by agreement. They are divided into what are termed *methodical signs* and *arbitrary signs*. The former are essentially to represent words, and to bring sign language into closer affinity to the vernacular. They, like natural signs, are expressed by gesture, and it is because they have the same outward form, covering a very different nature, that the danger in their use exists, in the hands of the inexperienced teacher.

A difference of opinion has long existed, and to some extent still exists, as to how far methodical signs may be employed with advantage. That in many instances they have been misapplied, and invested with undue importance, there can be little doubt; while totally to discard them appears throwing away an auxiliary that on some occasions may prove useful. The earlier teachers produced a system of methodical signs so perfect that each word had its equivalent sign, and the education of the pupil was to be accomplished by his learning to associate these together. When he could translate the signs of the master into proper language, his education was considered to be complete. That this was a grievous error there can be no doubt, and productive of more evils than one. In such a system, storing the pupil's mind with facts, or in other words, giving him information in the different branches of knowledge, is altogether lost sight of, while we do not really give him that acquirement we most desire to bestow—the language of his country. It is true that this must ever remain one of the great objects of our instruction; but if it is to be the mere power of writing words, or even sentences, from the signs made by the teacher, without comprehending their meaning, then, as far as its real usefulness goes, it might as well have remained unlearned.

Probably, no teacher now depends upon such means for giving a knowledge of language, but where much reliance is placed upon methodical signs, there will always be a tendency to suppose our pupils more advanced in this respect than they really are. Like children who will go very well while held by the hand, they immediately fall when left to themselves. It is true that methodical signs may not in all cases be altogether arbitrary, but still, in their use, they are essentially word-signs, and contrary in this respect to natural signs whose office is to give ideas —"*Res non verba.*" In signing lessons from books, too, a strong desire is felt to associate our signs with the words, closer than mere natural signs will permit, and perhaps there is no teacher, however he may condemn their use, that does not in some degree introduce them. Yet this should not be done without care being taken to ascertain that the meaning of the words which the signs are intended to recall or express is already known to the pupil. We have heard of teachers who would sign through a lesson, giving sign

for word in regular succession, in the belief that each sign they made was of equal importance and would necessarily give the idea. We could hardly have supposed that there could have been teachers with such madness in their "method." Let us see what would be a safer mode in signing such a lesson. Suppose a new lesson in history is to be taught, the judicious teacher would pursue some such plan as the following; first by natural signs he would impart the facts taught by the lesson, seeing that each was comprehended by the pupil. He would next see that each word was understood, explaining them if necessary by illustrations of their use in familiar occurrences. Then, if he wished to introduce methodical signs, he would go over the lesson again by this process. It is difficult to see what would be gained by it, yet it is the only safe way of introducing such signs in the operation. The language itself is already in its proper form before the class, and its translation into methodical signs will not give the reasons for these forms, nor rules for applying them correctly on another occasion, so all that is accomplished, in such a case, is a repetition, through another form, of the words already there.

There is another application of these signs, where they are supposed to be of especial value—in giving lessons by dictation. Is it true that exercises in dictation, in the case of ordinary children, are to correct their syntax and make them better acquainted with the modifications of words produced by their grammatical changes and relationships? Is it not rather an exercise to correct their orthography, to teach them to spell words correctly from their sound,—a difficulty not easily overcome in a language so arbitrary as ours is in this respect? What great lesson can it be, in the case of a hearing child, to write the word he hears named, whether it be noun, or adjective, verb, or adverb, in the active or passive form, singular or plural? Surely this can be no great mental exercise for impressing the peculiarities of grammatical structure; but it would be an important exercise in teaching the pupil to spell the word correctly by the ear, which is not, however, an object contemplated in our instruction. In the case of the deaf-mute, there would merely be a substitution of the words for the signs; he might, or might not, understand the ideas; and no principle would be given which would point out to him the proper application of the words in new combination. It does then appear that these signs cannot be ranked amongst the important auxiliaries of instruction, while they may yet possess a function of sufficient consequence to entitle them to a certain extent to a place in the school-room.

They offer a ready means, when teaching a lesson, of pointing out and correcting an error, and they enable us to *recall* to the mind of the pupil a word that may have been forgotten for the

moment. To this extent we have employed them, and we believe not without advantage. It must not be forgotten that there is a vital difference between *descriptive signs* given *methodically* and in order, and methodical signs—a difference of such importance that it can never be lost sight of without serious error.

For, if these signs are given to the pupil as equally comprehensible and expressive, the result will be that we shall find his mental progress far below what we had anticipated, and indeed what might have been the case had we analysed better our means of instruction. Descriptive signs in all cases convey ideas, while methodical signs are essentially word-signs, and cannot be depended upon safely to afford us more assistance than we have already indicated.

The other subdivision of artificial signs—those known more particularly as *arbitrary*, need not be dwelt upon, as their character is much more generally understood. They consist of a class of signs altogether conventional, but without claiming the verbal accuracy which belongs to methodical signs. Here a sign may be significant of an idea and represent several words. Hence the elevation of the thumb for *good*, and the little finger for *bad*, not only expresses these words but also such others as imply generally approval on the one hand or disproval on the other. Our signs for *duty*, *necessity*, *power*, &c., are all of this class. These signs are, however, so thoroughly recognised as arbitrary, that they are seldom misapplied or misunderstood, so that we need not here discuss them further.

Before concluding these observations, we shall offer a few remarks upon another feature of this language which is not without interest; we allude to its collocation, or the order in which the different ideas are successively introduced in a sentence. Different languages present us with great variety in this respect, and much of their individual peculiarity arises from this diversity of expression.

In treating of the collocation of sign language it is difficult to place it altogether in comparison with languages under grammatical regimen, if, indeed, it can be so compared at all. But, as signs as well as words are the representatives of thought, our object may be assisted by taking with us the logical as well as the grammatical classification.

Logical classification deals with the relation which the thoughts have to each other; while grammar analyses words according to the forms and laws of language.

The great logical divisions of a sentence are the subject, predicate, and object.

These agree generally in grammar with the nominative noun,

the verb, and the objective noun. A simple sentence may consist of three words only, expressing three ideas, or to each of these may be added others termed adjuncts. "The master praises the girl," is a simple sentence—"master" the subject, "praises" the predicate, and "girl" the object.

In the English language the order in which these three great parts are commonly introduced is that here given, and any adjuncts that might be required would be added by being put next to either of the limbs to which they might belong, as "the benevolent master kindly praises the little girl." This order, however, which we as Englishmen are apt to consider the most natural and expressive, is by no means the order followed by all other languages. The Latin may be instanced as opposed to the English in this respect. In the phrase "the master praises the girl," we should not, in this language, have "praises" standing between "master" and "girl" but coming last—the sentence "magister puellam laudat," bringing the verb last.

Now has sign language a peculiarity of this kind, or does it follow the order commonly found in the lessons we have to teach? In the illustration given above it appears to us that sign language would follow the order of the Latin rather than the English, and that in signing such a phrase we should feel the necessity of drawing the attention both to the *praiser* and the *praised* before we could introduce the *praises*. This indeed appears to be the really natural order, if there be such an order, for, if the process is analysed by which the act is arrived at, we shall find that the master and the girl were in the mind antecedent to the praise, and that this, in fact, only resulted after their connection, so that the predicate here follows in the mind after the subject and the object.

This arrangement is strongly felt in sign language, and any other is scarcely understood or but feebly felt. The fact, however, of various languages presenting us with such a difference in their collocation would almost show that it is not of essential importance which of the ideas given in a sentence are first introduced, and yet, as some languages are admitted to be more forcible, clear, and energetic than others, all modes of expression cannot be considered equally effective.

The want of inflexion of English nouns renders it necessary, in many instances, that the order given above should be used, since it would be impossible by any other to recognise which was intended for subject or object; for, were the sentence written "the master the girl praises," we should not know which was the bestower and which the recipient of the praise, so that the present arrangement seems a necessity arising from the peculiarity of the language. With the Latin it is different, for the

terminations *er* and *am* sufficiently indicate the subject and the object, wherever they may be placed in the sentence. Now, signs being a representation of the fact itself, as near as one party can play the parts of both, there is little difficulty in showing which is the active and which the passive agent, and, in following the order it does in arranging the ideas, sign language may reasonably be supposed to follow that most natural to the mind, when unfettered by any grammatical restraints, so that the Latin language, in this respect, follows closer the mental arrangement of the ideas than our own language does.

If we enlarge the bare simple sentence by an addition of adjuncts, these will be introduced associated with the limbs to which they belong, and in the order of their importance. In the sentence "the lion tore the body of the dead ass," we shall have, "lion, ass, body, dead, tore." Here again the Latin follows closely the sign arrangement, "leo asini corpus mortuum dilaniavit."

Hitherto we have only examined simple sentences: we shall next make a few remarks on those which are complex. It has already been stated that signs, as far as they are natural, deal with ideas rather than with words. One of our most eminent philologists has divided all words expressive of ideas into two classes, the *noun* and the *verb*—the verb the *quod loquimur* and the noun the *de quo*—what we say, and of what we say it. Hence, then, in sign language there are not gestures representative of those words termed *relational* equally significant with those which exist of that class termed *notional*. Every complex sentence consists of two or more simple sentences into which it may be resolved and which are bound together and modified by relational words.

In sign language we are obliged to have recourse to this analysis to bring the ideas clearly before the minds of our pupils. The complex sentence "the ship which has just sailed, and is so heavily laden, is going to Australia," may be broken up in the following manner, "the ship just sailed," "the ship heavily laden," "the ship going to Australia," and in some such manner would we explain it to our pupil. The sentence might be literally given by using methodical signs, but, for the reasons already adduced, these would not necessarily convey the ideas, and would be even less likely to do so in sentences still more involved than the one here given.

Complex sentences ought not to be introduced to the pupil till some advance has been made in the use of language as applied in simple sentences, and then, by a synthesis of simple sentences, we are enabled to show how a complex sentence is built up of these, and to teach the value of these relational

words by the use of which the simple forms are connected into the complex. We have hitherto given these rules which are generally observed in an unimpassioned sentence where no special *emphasis* is required; but when emphasis is necessary, then new features of collocation present themselves. There is a great rule in elocution that the beginning and the ending of a discourse should always be the most impressive parts. If this is true of a whole discourse, so also is it of its parts—sentences; "that," says Campbell, "which is uppermost in the heart, is nearest the mouth," and hence we can always render any limb of our sentence more emphatic by placing it first. If we were relating the following sentence, "a horse fell and killed Sir R. Peel," we should not put it into such a form as this, but place the object, Sir R. Peel, and his death, as the first ideas to be fixed in the mind, and afterwards relate the manner, or any other details.

So, whenever we displace the subject from its leading position in the sentence, that which takes its place at once becomes emphatic. In signs, this change of the position is the chief means we have of directing the attention of the pupil more especially to distinct parts of a sentence, and of bringing him to consider the suffering of the object rather than the doing of the agent. The passive voice of transitive verbs gives us this choice in ordinary language, and when combined with the modifications of voice used in accentuation, enables us, in speaking, at once to fix the mind of our auditory upon any passage, or indeed any word in our sentence, that we are desirous should be more particularly observed.

We have dwelt at some length upon this subject, because it is one but little known generally, and even amongst some teachers of the deaf and dumb not always rightly appreciated. Pictures, models, and illustrations, are all branches of this language, and are of the greatest value in teaching the deaf-mute—they address the eye, and hence become so important, as this is the only sense through which we can, to any great extent, approach the minds of our pupils.

The extensive collection of these aids in teaching by which we are now surrounded is a sufficient proof that teachers of ordinary children have become alive to the value of such auxiliaries, and to me, who have so long known their importance from experience, it is a sure index of the advance which modern pedagogy has made, compared with the time when the words of the lesson were allowed to fall coldly on the ear of the pupils, without any attempts to assist their perceptions by the use of models or diagrams.

We next come to consider dactylology, or spelling on the

fingers. This has been well described, by De Gerando, as being "nothing more than writing set free from its material dress." A letter is represented by a form made by the finger or fingers, instead of a form made on paper by a pen or pencil. It is a convenience, because it can always be had recourse to without the trouble of carrying pen or pencil; but it is less impressive than writing, because it does not possess that durability which renders writing so favourable to the operations of reflection. Dactylology only produces words and even letters in succession —each one has vanished before the next is formed. But writing preserves not only words, but sentences, entire before the eye at once, so that the mind can survey and re-survey the whole at a glance. In dactylology the words are produced one after the other, and are as fleeting as they are when spoken, but without possessing the power which emphasis imparts to speech, while in their form they are as complicated as writing, but have not its durability.

Many have a very erroneous idea of the value of this auxiliary in deaf-mute education; believing that the deaf and dumb have an intuitive knowledge of language, and have only to learn the alphabet to be able to spell words on their fingers, and so express themselves as well as others. Nothing can be further from the truth. Dactylology, after the finger alphabet has been acquired, can only be used in proportion as a knowledge of language is understood; and just so far as a deaf-mute advances in the knowledge of words and their combinations, will be his power of availing himself of the use of dactylology or finger-talking.

We have next to consider articulation. It has been shown that the earlier teachers paid great attention to this subject, and that now it is chiefly cultivated in the German schools, though it is also used in some of our own.

The mode of teaching this acquirement is, by making the pupil watch closely every distinct arrangement of the vocal organs in uttering different sounds; and where his eye cannot guide him, he is made to feel with his fingers in the mouth of the teacher the positions which the tongue, &c., take.

Nothing is more uncertain amongst a large class of pupils than their ability to learn to articulate pleasantly; a very small per centage ever accomplishing the task so well as to become respectable speakers.

Amongst the deaf and dumb there are all grades of deafness. Some can scarcely hear the loudest noises, while others can hear comparatively low sounds. A child that might hear and imitate correctly the sounds *a—e—o*, when uttered a few feet from him in the ordinary tone of voice, still might fail to hear continuous

sounds with sufficient distinctness when uttered in the same tone so as to imitate them, as he could the simple ones. A proof how accurate the hearing must be, to catch readily the nice distinctions of sound used in articulate language, and follow easily the various syllables as they gently glide into each other. It proves also how small a deviation from the normal state of hearing deprives us of this inestimable blessing, and shuts us out from holding communication through speech with our fellow-men.

If the pupil has still the power of hearing sufficiently to appreciate the difference of several sounds by the ear, then articulation may become a study likely to prove satisfactory in its results; but for the mass of the deaf and dumb, the results generally witnessed are anything but equal to the time and labour they cost. One proof against it, as a general mode of intercourse for the deaf and dumb, is, that educated mutes themselves never use it when talking together—always preferring signs or dactylology. Writing, too, has become so general an accomplishment, even amongst the humbler classes, that no one is now met with almost but can communicate freely by such means. Did articulation require little or no time to master its difficulties, its importance as a branch of instruction would be less questionable. But it is acknowledged that the time and attention it requires are so great, that in teaching it some other branch must be sacrificed. Writing *must* be taught, and this means of intercourse being so generally diffused, it is another reason why speech becomes less a necessary branch of deaf-mute instruction.

Travellers who have visited the German schools, in a hasty run over that country, have told wonders about what they have seen in teaching speech to the deaf and dumb; but when these cases have been examined, as they have been by persons of competent judgment, they are found to sink into those of an ordinary kind. The Germans themselves have, however, represented that they did not use signs in their instruction, but that articulation has been in their hands quite sufficient for imparting a knowledge of language, as it is in the case of ordinary hearing children. When, however, they profess to discard gesture entirely, they probably do not mean to refer to such signs as are called "*natural*," but only to the "*methodical*" inventions of the early French teachers. By no other supposition can the expression be explained, since there is no man among them who is not compelled to make constant use of natural signs in the instruction of his pupils. The testimony on this point is most abundant. A single paragraph from the excellent work of the Abbé Carton, of Belgium, entitled *Memoire sur l'Education Intellectuelle des Sourds Muets*, need only be produced. He says, "All institutions (for the deaf and dumb) make use of

signs; and when the *Allgemeine Deutsche Real Encyklopedie* attempts to distinguish the French from the German method, by the simple fact that the former employs signs and the latter articulation, it assumes a false ground of difference, since the Germans no less than the French avail themselves of the help of signs, in teaching the language of words. The reason is plain—there is no other possible method by which this language can be taught during the first period of the education of the deaf-mute." It may be taken, then, as a truth, that all teachers in all countries must employ *signs*, in the largest sense of the word, in the explanation of words to the deaf and dumb, and nothing else can take their place; because they are in fact the only natural interpreters of words.

From these remarks, it will be seen that articulation cannot take the place of signs as a means of instruction; and as its acquirement is more uncertain, tedious, and laborious than that of writing, it is not so well fitted to form the means of general intercourse for the deaf and dumb as speech, under its visible form, or written language.

From the enjoyments of music the deaf and dumb are entirely shut out, nor does it appear that by any analogous sensations can they be made to participate in the delightful emotions which musical expression produces. The deaf and dumb may be made to comprehend that the ear is cognisant of a variety in sound, as the eye is cognisant of a variety in colour, and that the ear may be pleased or offended by such sensations, as the fact is with the eye from colours, the taste from flavours, or the smell from odours; but the feelings which music awakens in the mind, that magic power described by Dryden, which

> "Raised a mortal to the skies
> And drew an angel down,"

can never be understood or experienced by the deaf and dumb.

Writing and reading may be looked upon as ends rather than as means in our teaching; for when we arrive at the period where they can be made available auxiliaries to any extent, the specific and peculiar characteristics of deaf-mute instruction cease.

We will now briefly explain how, by means of *signs*, the first knowledge of words is conveyed to the pupil.

The teacher must find out such words as will be most easily comprehended, and these are found to be the *names* of *objects* or *nouns*.

For the first lesson, let some of the simplest or best known objects be selected and placed before the pupil: he will probably himself make a gesture or sign which has been used by him to represent these objects. When this has been done with a few

examples, then let the pictures of the objects be drawn upon the wall or black board, and he will again repeat his signs, or point out the objects to which the pictures refer. This shows that he has already associated his sign, the picture, and the object together. He has now to learn to associate another picture as it were—one of a much more arbitrary character—with the object, viz., the written word.

To teach this, draw a picture of a *hat*, for instance, and at its side write, in a legible, well-defined hand, the word *hat*. Then explain to him, by first pointing to one, and then the other, that they both recal the object, or the sign. Hold up the real hat—he will make the sign. Point to the picture—he will make the sign. Then write the word *h—a—t*, and he will most probably make the sign: but if he does not, make it yourself, which will show him that these letters recalled to your mind the object just as his sign, or the picture, recalled it to his mind.

After a little drilling of this kind, and a few of the most familiar names have been gone through, some classification of nouns may be formed, such as objects in the school-room, objects in the play-ground, parts of the body, &c. And in this manner he would soon become acquainted with most of the names of the things around him.

Lead him next to notice the *qualities* of objects. Show him a *coal* and a *piece* of *chalk*—he would mark their difference in colour. A *slate* and a *plate* would exhibit a difference in *form*, and so he might be taught adjectives, of colour, form, texture, &c., using contrasts as often as convenient, to facilitate the operation.

Next would be introduced the *verb* in the easiest form; also the simple affirmation as expressed by *is*—in such sentences as "bring a small book," "touch the slate," "the mouse is small," "the elephant is large," &c.

After some practice had been acquired in these forms, the word *have* (meaning possession) might be taught in a similar manner, taking the illustrations from objects possessed by the pupil or yourself, in the first instance, and then extending them to others known to both, *e. g.* "I have a watch," "you have a cap," &c.

Teaching by illustrations of known facts, or of acts directly performed by the pupil himself, is always more impressive than teaching from any set of prepared forms, conveying general truths from lesson-books. A proof that in teaching the deaf and dumb, greater success will result from the ability, zeal, and ingenuity of the teacher, than from any peculiar system of lessons.

The verb, in its three great tenses of *present*, *past*, and *future*,

may be introduced by drawing the attention of the pupil to acts that are *now* taking place—*acts* that happened *yesterday*, and to things that *will* happen *to-morrow*.—[*The lecturer here illustrated how these were taught by the means of natural signs.*]

The pupil must be made to give examples himself of the words he has been taught; and, as he advances in language, he will become more and more able to do this, which must be taken as an index as to how far he has understood what has been taught him.

The particles, compound tenses of verbs, general, and abstract terms, must all be classified and arranged so as to present the easiest forms first, advancing in all cases from the simplest to the more complex, and graduating the progress so nicely, that each step taken in advance lessens the difficulty of the next.

When sufficient language has been acquired to make *rules* understood, then these may be introduced, but never without copious illustrations of their use. A good analysis and happy examples will do much more to quicken our progress than the most profound generalizations of grammar—for when such can be understood, our end is accomplished.

Of course, in the subjects of moral and intellectual instruction, the deaf and dumb would require a course similar to other children, such as geography, history, arithmetic, religion, &c. In our lessons on these subjects, it will be necessary for us to use the simplest language and the easiest arrangement of facts, but we need not wait till a thorough knowledge of language has been acquired to introduce them. These studies may go on simultaneously with that of language, if we help our pupils by signs, where the phraseology is difficult. Indeed the language in which our lessons on geography, history, &c., are written, becomes an exercise on language; while, by signs, we see that the *facts* contained in the lessons are all fully understood and comprehended.

We have now given an outline of the theory and practice of teaching the deaf and dumb, freed from the *charlatanerie* which overshadowed the infancy of the art. To advance further would be to enter on the domain of the practical study of the subject—a process which demands a long and laborious novitiate. But even with special aptitude and long preparation, with all the aids that experience, ingenuity, and patience can afford, the progress of a deaf-mute's instruction, is slow and uncertain; and the results prove in this instance, as in every other, that the perfection of nature is not to be reached by even the most elaborate efforts of art.

Having now disposed of the subject of teaching, let me, in conclusion, offer up a brief but earnest appeal in behalf of and for the

deaf and dumb. There are, doubtless, many cases of misfortune that call loudly for the exercise of benevolence and perseverance to comfort and solace their unhappy condition; but there are few whose lot is more sad than that of the deaf-mute. Persons so afflicted, if left without the advantages of instruction, may have the most brilliant qualities, but like that of the unpolished gem, they remain dormant if left to themselves. Uneducated, the deaf and dumb are not only deprived of all the hopes that can make this life cheerful, but are shut out from the prospect of a future and a better. "How gloomy," says Dr. Johnson, "would be the mansions of the dead to him who did not know that he should never die," and such must be the gloom of every uneducated deaf-mute. While, on the other hand, under the fostering care of instruction, he is enabled to emerge from this dreary loneliness; he no longer remains an outcast from that society amongst which he is, yet of which, he is not; but mounting to the high station of his humanity, he elevates his eloquent eye to heaven and thanks God for the consciousness of his own immortality, and the Divine mercies with which he is surrounded.

HOME EDUCATION OF THE POOR.

By CARDINAL WISEMAN.

SEVERAL papers have described the following lectures, as proposing the introduction of a censorship, or some other interference with the liberty of the press. They are now published exactly as delivered, from the short-hand writer's notes, with a few merely verbal corrections. But not a sentence or part of a sentence has been added or omitted, and not a substantial alteration has been made in a single word.

The public will thus judge of the correctness of the judgment passed upon them by the papers alluded to.

LECTURE I.

LADIES AND GENTLEMEN,—Those who take a real interest in education will agree at least in this, that it cannot possibly be commenced too early. We may differ as to the first mode of beginning this important task. We may not agree as to the first feelings which should be inspired, the first ideas that should be suggested to the infant mind; but all will still concur on this point, that the wax must be moulded while it is yet tender, that the seed must be cast into the ground while it is still soft. It is like the work of the cultivation of the vine. Scarcely has the sap begun to move, but the ground must be cleared from about the roots, and all superfluous growth cut off. It must from that moment be attended by a loving, but a watchful eye; by a

tender but an unflinching hand, which must guide each weakly tendril to its support, which must kindly bind up every luxuriant but promising shoot, which must sternly cut off every unfruitful bough, which must purge and cleanse each leaf, and stalk, and grape, and bunch, until at length the fruit is gathered in, and the cultivator is repaid for his toil by its luxuriant and wholesome juice. We thus easily agree when education has to commence. But when has it to end? When is the close of this important occupation of life?

If we look at that form of education which, being the most unvarying, and having been the subject of our longest experience, affords us easily the best practical rules; if we examine the education which we give to persons moving in the higher spheres of life, we may say, without hesitation, that education never ends. We are all, to the close of our lives, in a state of pupilage; not indeed any longer under the direction or the awe of pedagogue or professor; but we are, to the end, under the tutorship of our own increasing experience, our own developing intelligence, our own improving minds. And we never can say, without contradicting the experience of sages, of antiquity, and of every age, that we have got to the end of learning, or that the more that we learn is not merely a light to show us that we have further still to go.

If we look, for example, to those results of education which do not stand in immediate sequence to it, but for which education is, as it were, a preparation, we shall find this to be the case in every state of life. How many veterans there are now, who have grown swarthy and grey upon the quarter-decks of our noble squadrons, who, long ago, in the days when the memory of Nelson and of Exmouth was familiar in the mouths of their superiors, would have treated it as a scorn, had it been said to them, that they were not acquainted with every part and management of a ship, that they did not know even the smallest portions of its gear; and who yet are not ashamed now to begin once more, if I may so speak, or rather to continue their naval education, by descending into the obscurities of the stoke-hold, and allowing themselves to be initiated in the mysteries of the engine-room? And where, for instance, is the counsel learned in the law who, whatever may have been his boast of the unchangeable perfection of British judicature, is now ashamed to have lying upon his table manuals, elementary books, upon new forms of practice, consequent upon alterations which have taken place in the forms of law? Where is the skilful physician, European though his reputation may be, who, whatever may have been the theory with which he started in his profession in early life, has not found it necessary, or is ashamed to confess that

he has found it so, to modify it and improve it, after the discoveries of a Bell, or a Magendie, or a Liebig.

But if it be said that these examples, which I have chosen from various professions, only show that there is a great deal to be learned which is not immediately connected with our first or earliest education, and not that education itself has to be continued, I must pause for a few moments upon this point, because I think it will be of some use to elucidate what I shall have to say later. It is true, indeed, that the education which we give to persons of the higher class, is not directly and immediately calculated for that which may form the profession in after life. In the same bench before the professor will sit the future statesman, the future clergyman, the future soldier, and the future merchant. They receive, indeed, a common education—and why? Because the experience of ages has shown that the main, the chief object of education is not so much to fill the mind with learning, as to cultivate and develop its faculties. The object is to expand the mind, to widen the thoughts, to sharpen to an edge the intellect, to brighten the imagination, strengthen the memory, and give proper expansion and vigour to every faculty of man. While this is done by education, whatever may come afterwards will find already, in that which has preceded it, the very source of all its power and success. But it is even true that, in what forms the actual subject of education, its vital matter, we continue still long enough after we have left school, to perfect what was there begun. I myself am certainly old enough to remember having had to learn the history of Rome, of Greece, and of England before Niebuhr, or Thirwall, or Lingard had written; yet, should I not blush to say that the history of England, or that of Rome, which I know, is what I had learned before that time, what had been instilled into me in my schoolboy days, and that I have not continued those very studies, and endeavoured to go on improving by the new means of progress which have been placed before me? Who that has passed the middle term of life does not remember those days, when all that he could be taught concerning Egypt or Assyria was contained in a few introductory pages to the ancient history of Rollin; and what did he there learn? Why, that the most remarkable things in Egypt were its pyramids, and the inundation of the Nile, and that the marvels of Babylon were its walls and its hanging gardens! What a change has taken place in our acquaintance with those subjects, if we have continued our education in them!—if we have followed the discoveries in Egyptian antiquities from the first germ in Young, through the beautiful and interesting developments of Champollion and Rossellini, till we reach the more abstruse researches of Lepsius,

and when the whole catalogue of Egyptian kings has been unrolled before us, the very ages of their dynasties, the years of their reigns, the works which they raised, their inscriptions on their monuments. And as to that other great and mighty empire of Central Asia, what a flood of light is poured upon it from the recent discoveries of Layard and the decipherings of Rawlinson! Have we not continued our education in history from the day we left school till this very hour, and are we not prepared next year, and ten years hence, to learn as much concerning any other part of antiquity, which was in our early years obscure? And even descending to what may be considered the mere manual part of education, are there not many here present who teach their daughters those varieties of beautiful works which give such graceful occupation and shed so much ornament on the home, which in their days of youth were perfectly unknown, were as yet undiscovered?

So it is, then, with the education which we claim for ourselves, and those of whom we have the care. We should be sorry to teach them, we would not have them understand, that the day that they leave the college or the university, the work of their education is finished. We instil into them that, during those years, they have only been preparing the materials for a much nobler and a more lasting edifice; that they have laid, perhaps, a foundation deep and solid for erecting it, but that the work of self-improvement, of constant progress in knowledge, must be commensurate only with life.

Now, is this the theory, is this the plan, on which we are engaged in educating the great body of the poor? I must premise that, in this and in my next lecture on Monday, I do not intend to speak so much of that class which is known generally by the name of mechanics, who, living either in great cities, or in those fervid spheres of activity—the manufacturing districts—have access to institutes expressly founded for them; reading-rooms, libraries, literary societies, lectures, in which a considerable amount of knowledge is sought to be communicated to them, and in which no doubt many continue the work which they had begun in their earlier education. I wish to speak chiefly of the agricultural poor, of the poor that are dispersed in the dells and nooks of England, on the mountain-side and edge of moors, in sequestered vales and distant unfrequented regions, where they have but little access to the means of instruction; and where, whatever they obtain, must be derived from sources immediately in contact with themselves. They receive their education probably in the parochial school, or in some other benevolent institution that is immediately at hand; and after the children have imbibed a certain amount of learning, it is but too well known

that their education is at an end. Even we know how difficult it is to struggle against the prejudices of this class of the people, on the subject of education. Their parents object even to sending them to school. They, having been but little educated themselves, look upon their children as little better than, though youthful, still very useful, implements and machinery for their domestic profit—to work in the field, to commence early to earn what little they can, but to grow up entirely in that same rudeness with which their own youth was surrounded. It must be observed that the education which is given to them in the school is but slightly indeed correlative with what has to form their future occupation in life. You may say it reverses almost the method of education which we have established for ourselves. With us the greatest pride of intelligence is afterwards, when what we have acquired in the school grows up to maturity, expands itself, seizes hold on outward objects, conveying learning and knowledge from every side; and these, well digested in the mind, produce thoughtfulness, carefulness, self-control, and at the same time enable us to strengthen what has been cultivated in youth—the virtues, social, domestic, and self-reflecting. But the poor child has the whole of the intellectual part of his life concentrated in those few early years, perhaps in those few months, in which he is at school. The nature of his occupations afterwards is of a character that reverses what the Latin poet has described as the noblest mark and distinctive of the human race.* During the few years that he was under your tuition, you made him raise his face towards heaven, and the whole remainder of his life his looks will be cast, much like those animals, which he has to tend, down upon the earth from which he must work out his daily bread.

But suppose that you have given him some taste, some love of learning, some desire of improvement, some wish to cultivate those faculties nobler than mere physical power, or mechanical action, which in his brief course of education, with a noble pride he has felt within him, upon what can he fall when his term of school-time is over, when he goes home and begins his mechanical labour? What can you put into his hand to continue his progress in what he has already learned? Where is the literature prepared for him as it is for the rich man, proportioned to the amount of learning which he has already received, to the extent of light with which he has been favoured?

This is the great question upon which I have to speak, and it appears to me that there are only two methods of treating this most important social necessity. Either we must change the

* Ovid.

form of education for the poor altogether, and simply adapt it for their future life. We must adopt throughout England, a thing which I believe would be considered chimerical, quite impossible, such a system as Mr. Balson describes, or as has been tried by experiment and successfully, but still on a very small scale, in various establishments throughout England, of educating the poor at once agriculturally, from the very beginning, and making them little husbandmen from their infancy, only allowing learning to be as a pastime, a recreation, or, at most, as an improving and moralising agent; or else, it seems to me, to become a duty, when you have determined to give to all the children education, to provide also the continuance of education for the men. It is with this latter view that I have to deal.

Now, the first thing to excite public attention to any subject is to show its necessity, to prove the want which there is of attending to it. It must be shown that really we do want a literature for the poor, to excite the whole nation, for it is worthy of its attention, to exert itself for the purpose of providing it. Before I come more immediately to our subject, I will take the liberty of placing before you what has lately been done in France, in connection with this important public duty, because, although I could not for a moment suggest the same course of proceeding as has been followed there, because incompatible with public feeling and institutions, yet we shall be able to draw important parallels from what is the condition in that neighbouring country now so closely allied to our own, and perhaps, by a similar system of analogy, we may provide remedies, though in a different manner from what has been attempted there.

In France, it was well known that, for the last three hundred years, the agricultural population through the whole country was supplied with a special literature created for its use. This was diffused through all the rural districts by means of what is called the *colportage*—that is, pedling or hawking. Men, with a license for this purpose, carried into every corner of the land this particular class of books, prepared, written expressly, for the agricultural class. The centres of the publication of those works for the poor were, besides Paris, which must not, however, here be considered as the primary place, Troyes, Montpellier, and Epinal, at which three, great establishments have been occupied for years with nothing else than printing the literature of the people. The amount of volumes circulated in this manner was between eight and nine millions yearly, varying in price from a half-penny to tenpence. It was well known that little change had taken place in this class of literature for many years; that the same works had been sent round year after year with no improvement whatever, but in many instances they had even

become worse, till at length the government determined to have an inquiry into the character of the books so circulated, in order to take measures for the prevention of the circulation of such as were considered noxious or foolish. On the 30th of November, 1852, a commission was issued by M. Maupas, the Minister of Police, with powers to call in and examine every book that was circulated by means of the *colportage;* and with a view to secure this, an order was made that, in future, besides the hawker's license, it should be necessary that every book carried by a hawker should have a stamp of permission upon it. The publishers of these different works were invited, consequently, to send in their various publications that they might be examined, and approved or discarded. The number of works that thus came in amounted to 7,500. The commission, on the 21st of July, last year, upon the suppression of the ministry of police, was transferred to the home department, and there has continued its sittings weekly; and I have given you the return of books up to the present time.* Out of this multitude of works which thus came before the commission, and which were accurately examined in every part with the greatest scrupulousness, three-fourths were rejected, and not allowed to be carried any longer into circulation.

Now imagine what a state of literature this must have been, which had been infecting every cottage and every hut in the whole extent of France, not for five, ten, or twenty years, not for a hundred years, but, strange to say, the greater part of it for nearly three hundred years. This was the first step taken. In the course of this year M. Charles Nisard, the auxiliary secretary of this commission, published, in two most interesting volumes, a report upon what he calls "Popular Literature," in which he analyses or partly describes about 560 of the works which had been submitted for examination; and from this analysis we may judge of the character of the literature which has been diffused for so many years through France. It consists of an immense amount of superstitious works, that is, the old astrology in the shape of almanacks, of scientific works, of medical or veterinary treatises for the use of the poor. The almanacks are traced, every one of them, to the very almanacks that were printed in the year 1500; and they are attributed even at this day to the very same astrologers as are printed upon the calendars and almanacks of the sixteenth century. And then comes a mass of trash, a quantity of stories of robbers and pirates, and tales of a character little calculated to improve the morals or feelings of

* I am indebted, for these and other interesting particulars, to M Charles Nisard, who is mentioned lower down in the text.

the people. I speak not, of course, of such works as are absolutely intolerable, and cannot be mentioned with propriety, but of such as, on the face of them, appeared almost innocent, and to be merely written for the amusement of the masses. There must be some exceptions made; for although the system of carrying books in this way was not a religious system, because, besides this, which may be called secular *colportage*, there is a religious *colportage* for the carrying of religious tracts all over the country, of which I have nothing to say; still there were included in the lists of works thus published, and disseminated, a number of religious works. Some of them, indeed, might be called rather a burlesque on religion than instructive; but some of them, of very great age, are full of poetry of the most tender and graceful character, and are worthy of being still continued in the mouths and the hearts of the people. But with these exceptions, and they certainly are few, the rest of these religious works must be considered as belonging at any rate to a very low and dangerous class of literature.

Now what an immense void was necessarily created by the withdrawal suddenly of this large number of works from circulation. The next question, therefore, was, how was it to be filled up. The booksellers, of course, were immediately put to their wits, and in the lapse of a few weeks sent almost a sufficient quantity of new works to replace the rejected ones. But the greater part of these have not been admitted; and an important problem—the very problem to which I wish to call your attention here—is at this moment being solved in France. The government at first trusted to the public exigency, to the demand, for creating a supply. That did not come, and the question has now been entertained, whether the government itself should supply the want, or, at least, should instigate, and by rewards animate, persons of real genius and learning to prepare simple series of works for the people—histories, books on agriculture, elementary chemistry, and such other works as may be useful for them in the discharge of their homely but proper duties. This, as yet, has not been decided, because (as I have been informed by the gentleman whose name I have mentioned, and who has most kindly furnished me with many particulars on this subject) it was considered dangerous for the government to take upon itself a function like this, and so to enter into competition with the ordinary book trade. It has been wished to avoid this difficulty, which indeed is the one now under consideration. M. Billault, the present Minister of the Interior, has acceded to the general suggestion made by the commission, that the only chance of supplying the people with a sound and sufficient literature is by creating it expressly with the assistance, at least

the concurrence, of the Government. But we must probably wait some time longer before this difficulty is overcome.

Now, having shown, first, what was the state, up to the other day, of the literature of France—the literature, that is, which was prepared for the people—what was the food, the intellectual food that was furnished them through the press—it is time now to compare its state in England with what it was in France. We have seen what the French literature was—we have seen how the attention of the public and so of the government has been drawn to its pernicious character—we have seen that a remedy has been applied by a summary process to arrest the evil, or, in fact, if possible, to destroy it—and we have seen that there is preparation at least being made for the creation of another and a better literature, or that at any rate the necessity of producing it is fully impressed upon the French public and government. I might have added that some of the books which have been thus published, and up to a very late period circulated, are in their character so curious, and will become in a few years so very rare, that they are already being snatched up by collectors and placed in their libraries. There was one book amongst the rest, for instance, which had been considered completely out of print, but which has been freely circulating in the country; but now, for hardly any price, can a single copy of it be bought, for persons who wished to possess that rare and strange volume, "Macabre's Dance of Death," have caught up the copies which a few years ago were hawked from cottage to cottage.

No doubt the comparison to be made between the literature which our poor people have, and that which they have had till lately in France, will be in many respects in our favour; in other respects perhaps not so much. For allow me to say, that some classes of the literature which has been condemned in France, are to be found just as common in our own country. Into the more secluded parts, into the more remote districts, books are brought by pretty nearly the same process as they are in France—that is, they are hawked by pedlars about the country, although there are much greater facilities for purchasing in our villages, books of the class to which I allude, than ever there has been in France. And there is this further difference, that the French seem to have few, or no, cheap weekly periodicals; whereas it is well known that a peculiar class of penny publications particularly, issues in immense quantities from the London press, and by a most complete system of organization, is made to reach the most distant parts of the country. The circulation of these journals sufficiently proves this fact, for there are nine weekly papers—some of them, indeed, of a better class and higher

price than I have mentioned, but the greater part belonging to that class—the circulation of which, varying from 60,000 to 440,000 per week, makes the issue 1,349,000 a week. The greater part, at least a large portion, of these publications, I need not characterize; but included in this list are not those of a far lower character still, filled with nothing but scenes and ideas which should be kept as remote as possible from the minds of the uncultivated people. This is an evil which seems to be totally wanting in France; and we can easily imagine that the influence of a few volumes, brought three or four times a year by the pedlar who comes periodically in his rounds, which are read and then thrown by, cannot be so great as of those which come week by week. It is indeed like the pouring of poison, drop by drop, into the mouth. It is not felt to-day—it will not be felt to-morrow—but by degrees it undermines the moral constitution; for it familiarizes the thoughts with offences, and with even crimes, which we begin with dismay to see become daily more and more common. It is impossible that people living in seclusion, seldom communicating their thoughts with others, who know comparatively little about the great acts of justice which Providence publicly displays, reading week after week the recital of cruel murder acted in illustration before their eyes, and familiarized thus with the loss of life, with the shedding of blood, it is impossible that by degrees their minds should not lose that keen sense of horror with which in earlier years they would have contemplated the very thought of such guilt. And if the French have their tales of their own celebrated robbers—of Cartouche and Mandrin—why, where is the cottage where, if you find a book at all of any size, you may not calculate on finding the "Newgate Calendar," with its history of daring robbery and dark assassinations, and wonderful escapes, until the "Jack Sheppard" becomes the hero, and they who contemplate the crime before them learn, at the same time, the thousand ways by which its punishment may be avoided. These histories of pirates, of robbers, of cruel acts of various sorts, sometimes dressed up in a ludicrous form, to please the already perverted palate, must in the end act, as I fear we have reason to believe they have very considerably acted, in lowering the moral tone on the greatest of social crimes.

Our almanacks, in the same way, although immensely improved—although there are many really instructive and useful compilations—yet still often remain in that same miserable form in which they were a century ago; and perhaps those are the most liked and esteemed amongst the poor, which keep up the illusion of astrological prediction, and the foretelling of the weather. One printer has told me that when the duty was

taken off almanacks, he employed his press from June in that year until the following March in producing Moore's Almanack, a penny edition, of which he printed 2,160,000 copies. He said to me, "Would you like to know how I settled the weather?" "I wrote on a number of little papers, fair, rain, wind, frost, &c., I put them into my hat and shook them up, and as each day of the month was drawn, a paper was also drawn, and the weather of that paper was assigned to the day. And moreover such was the credit that my almanack gained, that a nobleman," —whose name he mentioned to me—"ordered it, and insisted upon all his tenants buying it, as their guide in their agricultural undertakings, so sure did he feel of my sagacity and my predictions."

Now my object in mentioning what was done in France was to prepare a parallel—an analogy. It would be quite out of the question to pretend to attempt to deal with the literature of the day for the poor, however pernicious, by the summary process which was sufficient in France. What, however, is analogous to it? It is certainly, I think, of importance that the public eye should be upon what is gradually forming, by necessity, the character of the people. It is important that those publications which at present creep—which I may say rather crawl—in their own slime on the surface of the earth, and like the venemous serpent at the beginning of the world, insinuate themselves into the peaceful and happy domestic circle, and there introduce pain, and ruin, and death, and taint the whole of a rising family—it is important, I say, that those reptiles should be seen and watched in their course; and therefore, if it is not in our power utterly to destroy them, we ought at least to provide to the utmost the antidote against their venom. If I were a person in a sufficiently public or political station to propose, with the certainty of success, such a measure, I do think that a parliamentary inquiry into the state of the literature now furnished to the poor would be a most saving and a most important measure. If a commission were appointed, which could not only call before it individuals conversant with the subject, but which by means of those appliances which a wealthy government possesses, could contrive to bring within its grasp, and under its eye, every single work that is issued for distribution among the poor; if such a commission were to have those works examined, analysed, reported upon, classified; then for the first time I believe the public attention would be called to the great necessity of the period—I think almost a necessity if not greater than, equal to, that of educating the young among the poor—the necessity of seeing that wholesome intellectual nourishment is furnished to those classes that can least help themselves; who, to the eye of a

government, ought to be considered still in a state of pupilage and childhood, requiring to be directed in what they do in this particular department of their social life, the improvement of their understandings, and the forming of their affections. Will any one say that this is a subject unworthy of the attention of the legislature—that it is not, on the contrary, after the example of France, one which really above all others, calls for its immediate attention? Why, we have not thought it beneath us, the legislature has not considered it unworthy of itself, to appoint commissioners, who should sift and examine, and analyse the perilous stuff that runs in our sewers, and if possible to remove that pestilential exhalation which hangs over particular districts. And shall it be thought too much to attempt to dilute at least, if it is not possible to neutralise, the noxious pestilence of a pernicious literature, which flows out through a thousand floodgates upon the most helpless of our population, and to thin, if we cannot dispel, that gloomy and murky, and threatening atmosphere of death which pollutes their habitations?

I know that to many it will appear that this work is sufficiently accomplished by the diffusion of religious tracts. Now, I am not by any means going to enter upon this subject, further than it bears upon mine, in the form of an objection. I have no hesitation in saying, that we may leave this portion of our literature to those who already have shown, on every side, sufficient zeal to prove that they can carry it on without further assistance. There is an abundance of this sort of literature supplied for the people. But I cannot bring myself to consider that this is to be held as the continuation of that intellectual and moral development which is given by education, exclusively and without other aids. In the first place, I cannot for a moment allow that what forms a great portion of the staple of religious tracts—little tales of fiction, pretty to read for children, but containing no manly, no generous, no just ideas of duty, and having nothing practical coming home to the sturdy ploughman's heart or his dame's, can form the continuation of the education which you give to the poor. And another class, from whatever source it comes, I must deprecate its being considered as in any way beneficially influencing the education of the people—a class which is entirely excluded from the works of a religious form, which are disseminated, as I have described, in France—I mean those which are of a decidedly exciting controversial character. Because I cannot believe—and I speak not of one body or another, but I am ready to condemn them from whatever source they may come—I cannot believe that good is done by putting sharp intellectual weapons into rude hands, which know not how to wield them in meekness and gentleness, or by inflaming pas-

sions in those in whom they are too easily excited, and with too much difficulty subdued. For I believe that education has one great object, which cannot be attained by these means. It cannot be a part of the education of the people to make them less neighbourly, to make them less kind, to one another, to excite in them hatred against others who are near them, and to make what they may believe form matter of consideration, in deciding whether they will succour them, and be friendly to them, and thus introduce religious distinctions into the social sphere. The object of the education, of the literature of the books that are diffused amongst the people, must be to make the man more manly, to make the woman more womanly, to make the child more child-like, to make them all more human—that is, to humanize them all.

I have now exhausted the time usually allotted to a lecture, and I hope that there will remain sufficient matter to occupy your attention at our next meeting. I, therefore, will draw to a conclusion. You will see the drift of this day's address. It is to awaken attention to a great educational want, that is, to the means of continuing the education of the poor after they have left their school, in the same manner as you take care to provide for the continuation of your own education, after you have finished your term of college or university life. I must observe, that while I have been speaking of the quantity of deleterious literature which is flowing on every side over the surface of the land, I have not had out of my mind other means which may possibly exist for the neutralizing of its evil effects. It may be said, "But are there not a sufficient number of works provided already which the poor could read and improve by?" I have taken pains to find works of this sort. There are works, undoubtedly, well calculated for this purpose—some single treatises, some in series—but there is nothing complete, nothing continuous; and I must add, that the whole being left entirely in the hands of private speculators, the prices are generally quite beyond the reach of the poor; and until public attention be drawn to this want we shall not find people who will take upon themselves the expense and trouble of making them known. My object is, after having thus called attention to the want, to see what may be its remedies, and in my next lecture I shall apply myself partly to that point and partly to matters of detail which could not enter into these more general reflections.

When a stranger comes to England what do you think it is that principally strikes him as the great beauty of our island? You will perhaps answer, the abundant crops waving so clean over the land, showing the perfection to which we have brought our agriculture, and consequently the skill of the labourer; or

ture is, in part, to be drawn or obtained from that which already exists, by a process of simplifying and adapting to the capacities: to, if I may so speak, the literary appetite and power of digestion of those whom we wish to serve; that knowledge which is already in our hands, and which by skilful manipulation may be made useful for this purpose. But I think we shall find, that our duty goes beyond this; and that after we have thus exhausted the means at our command, there is a work of creation before us; there are some departments of popular education, which we wish to bring home to the people, that must be made anew—created is the only word that I can expressly use, for them.

The first class of knowledge, you will easily understand, comprises all those various branches of it which we acquire by reading in the course of our education, or afterwards in the pursuit of that mental culture for which we have acquired a taste during that earlier part of our lives, that is devoted to being instructed. History comes naturally first before us. We have plenty of history already written. We have it spread through large voluminous works, we have it reduced to small compendiums, and we have not to look out for new facts. We have not to make fresh researches, in order to satisfy the wants of the poor in this department of knowledge. We have to take not merely what exists, but what does not exist in a form that is suited to them, and so modify it that they can appreciate, that they can understand, that they can profit by, it. Of course brevity and simplicity are the first characteristics of whatever is prepared for the reading of the poor. Yet, often these characteristics are, I think, misunderstood: between the large voluminous history of England, for instance, and the small abridgment for the use of schools, or for the use of the poor, what is the principal difference? Why, it is this. That whatever is, to use a common phrase, "dry," uninteresting, and difficult in history is preserved in the compendium. That which really forms the soul of history, that which in it speaks to the heart, to the moral affections, and even to the intelligence, is completely excluded from the shorter work. The chronology, the birth and the death of each king, a string of names of eminent persons who lived in their reigns, the wars in which they were engaged, a list of the battles which were fought, and the victories which were gained, a few words perhaps upon the one or two leading characters of the reign, such is the whole history of England that is brought before the poor. It consists but too often of nothing more than what may be called a long chronological thread, without any interesting narrative, without an anecdote, without an insight into the character of those who have ruled in former times, without a knowledge of the gradual

development of that with which every member of a community should be made acquainted, the rise and the gradual expansion of those liberties and institutions which he holds dear, and the gradual construction of that constitution in which he has, so natural an interest.

Now the real model of all history is that one written, not by the finger of man, but by the hand of God; and how has that been composed for us? Why, when a series of generations is wanted to connect one part of history with another, it is given; but then the greater, and the nobler events, or those which exercise a pre-eminent influence upon the Jewish dispensation, and those individuals who fulfilled themselves a high destiny, or were intended to exemplify in their character some particular virtue, have their narratives expanded, or their biographies carried into the most minute details. In this manner that history, independently of its higher and diviner character, is always welcome to the reader, as full of interest, and excites within him the noblest, the holiest, and the tenderest emotions. And so I think that history, for the very poorest, should consist more of readings in history, if I may speak so, than an attempt to give them a complete chronological account of all that has happened from the establishment of the nation until the present time. Let there be a sufficient connection between great periods, like that of a rivulet which from time to time expands itself into a magnificent lake, hemmed all round by beautiful scenery, which serves to connect the waters of one with those of the other, but which itself can present no charms compared with what it receives when it is thus enlarged, magnified to us, and graced by the accompaniments of grandeur and beauty.

And what shall we say of science? Is it possible to prepare it for the very poorest? I do not see why it should not be perfectly possible, if we can bring ourselves to the conviction that a great amount of science may be taught without its formal technology. If you will speak to the poor of the laws which regulate fluids at rest, or which regulate them when in motion, instead of heading your treatises with the names of hydrostatics and hydraulics; if you will employ the immense power of our language, in combining its elements in compound words, almost co-extensively with more ancient and classical idioms, and make terms that can be grasped and understood by less-cultivated intellects,—it seems to me that the principles of science, as now known and explained, are comparatively so simple, that a sufficient amount of it might be communicated even to the poorest, in a form that would be interesting to them. And it might be exemplified by such common every-day operations as they are in the habit of witnessing, as they themselves take part in—those

operations, for example, which relate to the motion of fluids, to which I have alluded, by the drainage, the damming, and the pumping of water, or whatever else they may be in the practice of employing in their agricultural labours. If, to confine ourselves to this branch, it were explained to them simply how results which they witness come from a given cause, what is the simple principle by which the effect of their operations are regulated, I have no doubt that they would be eager for such science—they would be greedy of it: For we cannot help observing, when we are among the poor, how glad any one of them is to be in possession of a little knowledge, which others have not; if he has picked it up by chance, how pleased he is to make what may be called "a learned speech," and communicate to others that little advantage which he himself possesses. But if there exist this desire of knowledge, there is no reason why even science should not be made familiar, and brought down to the intelligence even of the poorest.

So may we speak of other branches of learning. There is an immense deal in them which cannot fail to be most interesting to the poor; all especially that has exemplification in the objects that are under their observation and connected even with their pursuits. Natural history surely, in all its forms, whether relating to plants, or to animals, or to insects, to those which are noxious, to those which are useful; then the habits of these, their instincts, they having the opportunity of verifying every statement that need be placed before them, cannot fail to secure the attention, and at the same time improve the character of the poorest class, if a manner be found of making them familiar with them.

This sort of instruction, of course, may be conveyed in various forms. It is not necessary that it should be always delivered in a didactic manner, by dry instruction. It will assume sometimes the form of familiar dialogue. It will, at times perhaps, be wrapped up in some little amount of fictitious narrative, so lightly contrived as not to shut out for a moment the higher and better purpose that is intended; at the same time without any great attempt at depth or abstruse science. In this manner a body of literature might certainly be prepared for the people, comprehending history, science, and a knowledge of those objects—their purposes, their uses, the manner of employing them—with which they are in contact in every-day life.

Nor would I exclude, by any means, even works that are for simple recreation, so long as they are moral. The people require them. They must not always be studying. We should get a taste, and even a passion, for reading excited in them, by giving them a literature which does not cost them any great labour,

but which, being merely recreatory,* at the same time has contained in it a moral that is simple, and being on the surface, easily understood. The attempt to teach them anything profound in this way, would certainly fail. We have, I think, a very striking illustration of this. There is not, probably, in France a single *colporteur* who has not in his pack, and perhaps not an English vendor of books, a single hawker, who takes them from place to place, who in his basket has not two works, with which we are all most familiar—"Gulliver's Travels," and "Robinson Crusoe." Now the first was composed by a man of the greatest genius, by one of the first scholars, one of the most powerful though simplest writers that England has ever possessed. He meant it to be a book, as it was, filled with the deepest satire, reflecting most bitterly upon those opinions which he himself did not hold, laughing to scorn even science as it was then being developed; and yet that book has sunk down to being a mere child's story-book. It is read by the poor, it is read by the little ones, without their comprehending anything of what was the primary object of the book. Its amusing incidents are all that they care for. The other was written without pretence. Everybody sees at once the simple lesson which it teaches. Every one, the child and the man, feels how he would have acted, or wished to act, in the same way, when placed in the same circumstances in which its hero was placed. Its lesson is simple—that of using energy and the means which Providence happened to throw around a poor outcast upon a desert island, to create for himself a home, and to make himself contented with his lot. And it is the simple picture of what he did, without lofty emotions and without pretension, which has made that book a favourite with every class, and one which cannot but always produce a sound and moral impression.

What shall we say of biography, anecdotes,—the history especially of persons who have shown great ability, or have displayed great moral worth especially, in the same class of society to which they whom we are seeking to instruct belong? Through every age, ancient and modern, through every country, we shall be able to collect an abundant store of such history, biography, and anecdotes of persons who, almost in childhood, or afterwards in manhood, nay even of women of the poorest class, who have shown themselves great and heroic under trying circumstances; examples of those who have nobly battled with the adversities of life, and without rising perhaps from their station have grown superior to this world, and have manifested what great virtue, what high moral worth, may shine even in the poor and comparatively uneducated.

And how is all this to be procured? All this history, all this

science, all these various treatises on natural subjects—whence are they to come? Why, I must say that I cannot for a moment contemplate any want of persons in this country, who would gladly devote themselves to the providing of whatever may be necessary for the instruction of the poor. I think that the more a man has advanced in true wisdom, in moral learning that is, the more he is elevated above others by his extensive and deep acquaintance with any branch of literature or science, the more fit he is thereby become to labour for the intellect of the poor. There is no such thing, in my estimation, as a person's being raised above such a work; but, on the contrary, the most distinguished scholar is the fittest person to undertake a popular treatise upon a branch of science or of literature in which he is the most perfect, and make it suited to the capacity of the least instructed. And I do not believe there is any one, however great or high his position, or however wide-spread his reputation, who would refuse, if he were asked to write even the simplest and most elementary book for the use either of schools, or of the poor. I believe it is the noblest consecration which genius can make of its powers on the altar of society.

Having thus briefly shown what are the different parts of knowledge which, existing sufficiently and ready at hand, can be adapted and prepared for the uses of the poor, I now come to the second part of our duty, which is that of creating what does not yet exist. Do not be startled, if I say boldly, that it is absolutely necessary to create a poetry for the poor. It does not exist. A poetry of a twofold character, a poetry of narrative, and a poetry of song. It may be said that this belongs to a more ancient and more romantic period, that we have come to the days of practical utility, and that to fill the people's thoughts and minds with works simply of imagination, with melodious verse, however beautiful, is assisting them in no way to the great aims of their existence here. It will not be helping them forward in the duties of this world. This I will venture most completely to deny. The people will have poetry, whether it pleases us or not. They will have their songs, they will have their ballads; and if you do not furnish to them such as are worthy, not merely of rational, but of Christian beings, if you do not supply them with a stock of such literature as will not taint them, but on the contrary will cultivate and elevate them, you must be content to see them pick up their songs in the street, and buy such as we know by description only: for they are such as none of you would allow for a moment to contaminate your domestic circles.

In other times, in our own country, we are all aware that

even the more homely duties of agriculture were made familiar to the ploughman and the labourer in verse; that the "Hundred Points of good Husbandry," or the "Shepherd's Calendar," or other productions of such writers as Tusser, were familiar in the mouths of the people, because they had in them their best instruction, for the times, in agriculture. And indeed even as yet, there are numbers of those old jingles and rhymes which have passed into proverbs, and are familiar to the mouths of the people; such as their prognostics of weather, their anticipations of changes in it, the description of the time and season for performing agricultural operations. These are yet described by them in rhyme, because they have come down from old poets, who thought they could not better impress on the minds of the people, most of whom at that time could not read, the lessons of what was their art, than by thus, in some part, embodying and embalming them in homely verse. But, besides this, there is a power in the songs, or poetry of a people, which has been felt in every age, and may act either perniciously or most profitably.

I need hardly allude to ancient times. I need not speak of the influence which the bard or minstrel exercised almost upon the destinies of empires; but even in modern prosaic times, we have witnessed what striking effects have followed from the power of the Muse. It is certain that in France many national ideas and attachments were kept firmly rooted in the minds of the people, by the songs of Beranger. And we should not lose sight of that old saying of an eminent man, "Let me have the writing of the people's songs, and I care not who has the making of their laws." So powerfully was it felt, that the power over the people of the gentle charms of song which goes at once to the affections, was such that it might even sway the legislation of the country. Germany, in our times, have given proof of the minstrel's power. During the late continental war, when all Germany was aroused as one people, there arose likewise a poet who embodied in himself the whole of this national feeling, who vividly committed this feeling to verse, which put into the mouths equally of the soldier and the peasant, national sentiments of unity and of bravery. And so Koerner, by his "Lyre and Sword," proved how truly it was possible to entwine the laurel round the blade without dulling its edge, and that a man might have in his heart at once the tenderness of the bard and the courage of the warrior. For if his life was that of the poet, his end was that of a soldier on the field. And later still, it is well known to all, what a powerful enthusiasm was excited through the whole of Germany, a few years ago, by the celebrated song of the "Rhine"; which made the whole nation, or rather that great alliance of nations that are bound

together merely by the spell of a common mother tongue, unite themselves into a firm bond of resistance to any possible invasion. And this bond was woven by their poetical sympathies being excited for that noble river, which they had always considered to be the peculiar property and exclusive ornament of their own country. Even among barbarous tribes too, the effect is the same. The independent feeling of the Albanian mountaineer has been kept up (though it led to a desultory sort of warfare), in great measure by the collection of native patriotic songs, full of wild beauty, loved by their soldiers and their shepherds, which made them feel that, at every cost, they must preserve their independence amidst the free air of their own rugged homes.

In our own country has it not been so? In the time of the civil war, who does not know what influence the cavalier songs had among those who espoused the royal cause, and what pains were taken to make them known and sung, even after peace was restored, as the means of keeping alive in the breast the peculiar loyalty which was then required? And, in later times, who can forget that "Song of the Shirt," which was in everybody's mouth? What a beneficial influence did not that song exercise upon the rich in favour of the poor! How it awoke more kindly feeling in favour of an oppressed class of society, than article upon article in the newspapers, or speeches or pamphlets, though proceeding from men of genius or learning, had been able to raise!

Then shall it not be the case with our people too? Is it not important, is it not necessary, that we should provide for them likewise this poetical literature, without which, I may say, no country has ever been thoroughly civilised as yet? And I really must say I firmly believe that if, at this crisis, there had been ready songs for the people,—at this moment of war, so new to us in our generation,—which, without exciting any unchristian sentiment of hatred or animosity, should have raised a just indignation against the perfidy of our enemies—should have made the people enthusiastic in their feelings for our army and navy—should have been full of loyal devotion to the crown and determination to preserve its honour—this war could not have been the dull and dead thing it has been. And, more, I think that one might even recommend the Chancellor of the Exchequer to have such songs prepared. For if we are to go on for a long period with war-taxes, if such songs were in the mouth, every hour, of the people in every hamlet and every field, they would be the best auxiliary to the tax-gatherer—and at least neutralize some portion of that grumbling and complaining, which we all acknowledge to be, at his approach, characteristic of our race.

But some will say, "that is all very well; you can set men to write books, you can put a history into the hand of a clever man, and say, reduce me these nine volumes to one short manual; and if he *is* a clever man, he will do it." But an old axiom says, that you cannot make a poet; you cannot call a man, of whatever genius, and say to him, "sit down and write me a volume of such poetry as the people will love and sing." I own it. But we are not unprovided with the required means. And I say that he will show himself the greatest and the noblest-hearted poet, who will be the most ready to come to our assistance in such a cause. When the celebrated Göethe was one day wandering through the fields, he heard a peasant singing one of his beautiful lays—that which begins, "Kennst du das Land?"—which Byron has imitated in "Know ye the Land?"—and he said that that tribute to his poetic genius, of being in the ploughman's mouth, was to him more, and flattered him more, than all the elaborate criticisms of the learned, and the court and homage of the sovereigns throughout Germany; and that for the first time he now felt that he was a poet. And why, I would ask—why should the lays of ancient Rome be alone thought worthy of that flowing and glowing pen,* which has shed such a charm about them in addition to that which they had received from legendary history? Are not, on the contrary, the home thoughts and the home deeds of this our island worthy to be made familiar as household words to the poor, and to be read or recited in the evening as tales of the hearth and of the heart?

Then, as to our songs, can we be in want of authors for them? There is one genius who belongs certainly to both the hemispheres, though it was not ours that gave him birth—one who, by his keen perception and his warm love of whatever is great or beautiful in nature, whether it be in "forests primeval," or upon the sparkling shores of Salerno—who, by his intimate acquaintance with the depths, with the flexibilities, and, what is still more, with the simplicity of our language—who especially, by that warm and affectionate appreciation of what is true and noble, and honourable and tender in life—whether among the high or among the low—seems eminently calculated to give to the people, and to the world, that which we so much want. And much as we may have admired such creations of poetic genius as "Elsie," or "Evangeline," I am sure we might anticipate still greater pleasure from a collection of the people's songs from the muse of Longfellow.

But such words would require a music worthy of them. Now,

* Macaulay.

standing as I do in this hall, with you as my audience, in a splendid edifice, the greatest and noblest that private enterprise has yet raised to the muse of song,* I am sure it is due to him who has done so much for the people, to express not only admiration for that peculiar talent which he has developed in the creation and propagation of his great work, but gratitude for having conferred upon society a great boon, as he has done, by eliciting a new means of recreation, a fresh source of cheerfulness, capable of exercising upon multitudes a refining and an inspiring influence. For I believe that the progress of music in our time, its great simplification, immense diffusion, and its practical introduction into such new spheres of life, is one of the most characteristic, and noblest symptoms of the interest which this age takes in the good and happiness of the poorer classes. And yet shall I venture to say that something more has to be done? In the village school, in the small country choral union, the elements are but units, which are soon dissolved and removed one from the other. After they have sung in chorus joyfully, whether sacred or profane songs—I use the word, of course, without meaning reproach—each returns home. It is as if one string had been removed from the harp—it carries not away its power of harmony. I think it is of the utmost importance that, in addition to the choral music which is now so general, there should be also a system of melody taught—that is, of songs adapted to given tunes, which may be easily carried away by each hearer. I would have, in other words, every child, when he goes home in the evening from his school, to be there as a cricket upon the hearth, cheering the whole house, making his humble cottage vocal with his fresh and his joyful lay. And then I should not be even content with this. Why should it be, gentlemen, that the highest description which poetry can give of the music of our agricultural pursuits, cannot go beyond making our ploughman whistle at his work, while the Italian vine-dresser is naturally expected to make the whole valley ring, and the hills echo with his thrilling and vivid *ritornello?* I would have the English agricultural peasant a songster, as well as him of southern climes; and therefore when a boy has finished his education, I would have him bear in his memory a stock of songs which should cheer his toil for life—songs full of affection, towards everything around him, literally filling his heart with love of his home, making him believe it to be, however humble, to him the happiest and most sacred spot on earth; love of the very earth itself, which submits to his rude handling,

* St. Martin's Hall, built by Mr. Hullah.

and repays the labour of his hands and the sweat of his brow by filling his arms with the teeming abundance of its womb—love of the various domestic creatures that look up to him for their sustenance, and see in him their providence, and pay him back abundantly by the food and the clothing which they give him; love for nature in every form, making it always appear to him fair; whether it be in the storm or in the sunshine, in the gloom of winter or in the bloom of summer—always the same, glowing and joyful; but however bright, ever showing him, piercing through all brightness by its superior brilliancy, beaming ever upon him, through every part of her, the face of a gracious and a bountiful God.

If we have to create a poetry for the poor, I must add also we must create an art for them—for that art does not yet exist which is adapted to their capacities, or which is capable of continuing their education. I need not find fault—it is not my province to blame—I am not come here for that purpose—but I must say that whatever has been yet prepared for the poor, either as school-prints or as cottage-prints, as they are called, are totally inadequate to their object. Having made a careful comparison between those that have been provided in this country, and those which they have in France and Germany, I am sorry to say that the superiority is on the other side of the channel. But we must not despair. I think we have begun rather upon a wrong system; and that if we change, in a very short time we might produce admirable prints, such as the people could understand, and such as would really instruct them, remembering always that old, very old saying—that pictures are the books of the poor and the ignorant. Let there be no attempt at elaborate compositions. I believe that we could make a Scriptural, or an historical subject, much more intelligible to a common understanding, by a simple drawing in accurate outline, such for instance as Flaxman would have given us, than by any attempt at grouping many figures, and bringing out a great effect. Every line which does not tend to define the necessary outline, and to determine and characterise expression, is thrown away upon an untutored imagination, or an eye not accustomed to pictorial art. We must observe that in foreign countries, the sight of even the poorest peasant becomes gradually formed to the contemplation of a picture, because in every church he is sure to have seen, from infancy, one, two, or more productions of the pencil. They may be poor, but still he has been accustomed, more or less, to form ideas of distance in perspective, and balance of colours which familiarise his eye with the common elements of painting. But, generally speaking amongst us, you present a picture to persons who have no means of forming in

themselves a taste for painting; all you want is to bring home to their minds, and also to their affections, the simple story which is related by it. If that plan were followed of outline simply—that outline filled up with colours, few, and without much if any shading, I am sure we should soon produce most beautiful drawings, so that the poor would at once understand what every figure was doing—what it was saying.

I have mentioned Flaxman. Flaxman's designs are of course unrivalled in the perfection with which they are drawn. I do not allude to them to propose our attempting to rival them, but to exemplify the way of disposing of figures with the utmost simplicity, and having as few lines as possible. He, in fact, only took as his guide a still more ancient art in the Etruscan vases, which tell their story as no complicated painting can do. We have the simple outline of a few figures, with the colour laid upon each, and nothing more. And again, at a later period, when art had almost disappeared from Europe, and it was preserved in the old Basilicas by their mosaics, the same plan was followed. The outline was made strong, and with scarcely any shade, colour was put upon the figures. I should have been glad, if I had had time, to have given you a clearer idea of my meaning by having had prepared by some eminent artist, who, I am sure, would have co-operated with me, some exemplification of it. But I think it is worth the consideration of those who are practically engaged in promoting education, whether this would not be a simpler, cheaper, and far more efficacious way of bringing art before the poor, of creating an art for them, than the miserable coloured lithographs, which are now put before them as illustrating sacred or profane history.

I must be brief in my closing remarks, though I have an important portion of my task yet remaining. Suppose, for it must have been until now a supposition, that there was a force created, a body existing,—call it a committee, a society, whatever we please—which would give an impulse to these various powers of production and creation, then the next question comes, how is the produce to be taken home to the poor? how is it to be brought within their reach? I must observe that one of the great, most necessary, requisites for such a literature as I have proposed is, that the price of everything should be reduced, so as to bring it not altogether within the reach of the poor, for everything could not perhaps be brought down to that scale, but within the reach of benefactors, who are willing to do something for the poor. Now, in what way would this be done? It appears to me, in the first place, that we might excite a love of literature, of learning, in the breasts of the poor, that we might even make the student, the boy who has left school, take with him a love and a

desire of reading, and become the instrument of his parents at least learning by listening to him, if nothing more can be done, if this was kept in view during the time of education. I have inquired, and, as far as I can learn, there seems to be nothing prepared in this country, expressly for prizes to be taken home by the poor, in the shape of books; for, if prizes are given of books, they are such books as have been printed for other purposes. Perhaps they may be expensive works, and handsomely bound, but each work has not been written especially that the child may take it to his home and be proud of it, and make his parents proud of it, and be able to let them know what it contains if they cannot read it themselves, or induce them to read it, because it can be called his own book or library. This is not the case abroad. There is a distinct literature of this sort for children, not interfering with their school-books. There are prize-books which they take home with them, and which constantly produce these beneficial effects. Although I have collected a large number, I will content myself with showing a specimen of the prizes which are given in the poorest schools in Paris. This is a little case, ornamented of course, to suit the child's taste and the taste of the poor. Here he has in it a complete library of nine volumes. If you look through them, you will find that they are not school-books at all, but that they contain a variety of reading on almost every topic. They are a perfect encyclopædia—poetry, riddles, stories, geography, domestic economy, domestic medicine, tales of every sort, anecdotes from history—in fact, I am astonished at the variety of subjects which are here put into the child's hand, not in a school-book but in a prize-book, to take home with him and read at home. He must value such books gained in this way, and his parents must be proud of them, and they cannot open a page without being desirous to read more, and I need hardly say, that the tone is highly moral, and religious throughout.

I would therefore suggest, that a system of prize-books intended for the reading of the working classes, ought to be part of any plan for procuring them a literature. Then, of course, if we suppose there is a feeling excited, not, perhaps, by my feeble words, but by what others, whose attention will be drawn to the subject, may say and write more powerfully as to the existence of this want, there will certainly rise up persons who, through a private spirit of enterprise, or joining together for the purpose, will give an impulse to the production of works that are required to satisfy this new craving. On looking over the catalogue of one house in Paris—that of Hachette—although it is completely a company of private booksellers, it strikes me that there is no

catalogue of any society in England professedly established to provide books for the poor, though backed by large voluntary subscriptions and grants, that can equal the stock of educational books and books useful for the poor that are to be found in that one private house. This shows how much can be done by private enterprise when there is a demand. I believe if it was known and felt, that we want a store of good literature for the poor, it would be created, and that there would be found persons abundantly active, energetic, enterprising, requiring no assistance, to produce it at such a rate as would bring it within the compass at least of the benefactors of the poor. I find that in Paris, at the beginning of this year, there was a meeting of all the charitable societies of every sort. Whatever their particular objects might be, they held their meeting for this very purpose. I have in my hand a copy of the circular which they sent to all the booksellers of Paris, and I believe of France, requesting them to forward to them a catalogue of such books, "good books" as they call them, as are fit for circulation among the poor, with the prices attached to them, the lowest prices at which they could be given, and to send two copies of each; that they might make a selection. The object of making this selection was, that they might recommend to the charitable in every part of France what books they could with safety send for and distribute. I think it is worth while to read one sentence out of this prospectus, to show the views of these religious societies.

"By 'good books' the committee of the charitable institutions does not merely understand elementary treatises and books of piety to which this title has been given until now. It calls good books not only those which may edify the soul and those which may honestly recreate the mind, but all those that treat of every branch of human knowledge, of philosophy, of history, of archæology, of political economy, of agriculture, of the natural sciences, of the exact sciences, of all the useful arts, and of all the liberal arts, provided that the love of art, and of science, and of erudition is not made in them, as is too often the case, a pretext for attacking the science of sciences, the revealed science, the teaching of the Church."

This shows the just and liberal view which the religious societies of Paris are taking of the education of the poor, and of the classes of works which they wish to diffuse among them. There can be no doubt, therefore, that in England also, if attention be paid to the want of such a literature, if the means by which the want is to be supplied be really considered (and means are sure to be taken to supply any acknowledged want), the void will be filled up, that literature which is now wanting will soon exist,

and that deleterious literature which exists will either be gradually diminished, or will at least be so completely diluted and counteracted as to become harmless.

I must now conclude. There are two duties very distinct the one from the other—the one is to give an impulse, the other is to guide it. I have no pretension to any power in the second. If I have succeeded in the first I am satisfied. If I have touched a chord which is in harmony with that which has thrilled with its music, till it has filled the whole land, the cry for, the determination to have, education, then I know that its note, joined to that, will grow and swell too, and soon have a response in every philanthropic breast. And I have that confidence in the public of this country, I have that full reliance upon its high sense of its social duties, that I am sure, perfectly sure, that once the feeling is excited, there will be no rest until the duty which it imposes is complied with. It is enough to make known a public duty for it to be nobly and gloriously fulfilled.

ON MATHEMATICAL GEOGRAPHY, AND EASY METHODS OF TEACHING IT.

By HUGO REID.

THIS is a subject much neglected in the majority of schools, of whatever description, partly, of course, from the number of other subjects demanding attention, but, partly also, because it is thought dry, uninteresting, and difficult, because a globe is considered essential for the purpose of teaching it, and because it is supposed to belong more properly to the subject of astronomy. No doubt it may be included in astronomy, but it does not the less belong to geography. The object of that very mixed branch of knowledge is to exhibit the characteristics of the different parts of the earth's surface, and as there are striking and well-defined differences arising from astronomical causes, geography must be viewed as incomplete that does not describe these as well as the other characters of the various regions of the surface of the earth.

That the subject is neglected, not only in common but in the higher class of schools, is evident from the various school-books on geography, several of which almost entirely pass it over, while in many there are errors or imperfect explanations which prove that the authors (mostly teachers of ability and reputation) had never turned their attention to the subject. Meridians are defined as circles, instead of semicircles, and in some books are not defined at all; the tropics and polar circles are defined merely by their latitude, or, as the four remarkable parallels. In one work the axis is defined as a line from north to south, which are not explained till the *following* paragraph, where they are defined as the ends of the axis.

The sun's verticality and terminator are, in many works, not referred to at all; and in one work, the explanation of north and south is made to depend upon that of east and west, which are defined as the points of sunrise and sunset! two points which vary through many degrees in the course of the year. These instances, selected from our best school-books, prove that the subject has not hitherto received much attention. It is the object of the present lecture to show that there

are parts of mathematical geography which are easy and interesting, and which may be taught without the aid of the globe, by means of only the common map of the world in hemispheres. It will be found that the subject is calculated to be useful, not only for the information it supplies, but for the precision of expression required in its definitions, the mental exercise involved in a clear apprehension of its definitions and propositions, and the observation and reasoning it excites. It forms an admirable preparation for the study of astronomy, and incentive to that study: and, if properly taught, gives great additional interest to ordinary and to physical geography, and assists in fixing in the mind the positions and certain important features of numbers of leading places on the earth's surface—points which every one should know and likes to know. It is as essential and as interesting as physical geography, and being more definite in its character, is fully better adapted for the instruction of junior classes.

Mathematical geography should be begun soon after the child has become acquainted with the nature of a map, and the general geographical features of its own country; and the *first* lesson should be to teach how to find *north and south* by the *pole star*, and the *sun at noon* (the shadow then pointing north), and thence the other points of the compass, so that the real meaning of them may be known, and the way to come at them in nature as well as on a map. The fixity of the pole star, in contrast with the other stars which describe daily circles round it, and the coincidence of noon with the sun reaching its highest elevation for the day, should be pointed out, and some notice should be taken also of the indications and nature of the mariner's compass.

The *second* division of the subject relates to the *roundness of the earth*. In many cases, the teacher will find it best to let this rest upon his word, deferring the proofs to a future time. When he does enter upon it, he should take great care that the details of these proofs are entered into so as to make them real exercises in reasoning, for which purpose they are very valuable, if properly used. These reasons are too often taught dogmatically, the learner not understanding in the least how the alleged reasons operate in proving that the world is round, but simply repeating the reason as he has heard it, like a parrot. Besides the proofs from the world having been sailed round, and from the bulging out of the surface of the ocean, those from the sun rising later as the place is further west, and from the circular outline of the earth's shadow in eclipses of the moon, are full of excellent matter for developing thought, if thoroughly entered into.

The *third* division of the subject should develop the nature of *rotation*, the *poles*, and the *equator*; previous to which a few preliminary definitions are necessary. It is not advisable to encumber the young mind with many definitions; still a few are essential to a thorough understanding of the subject. Perhaps those to be referred to have been already given in object lessons; if not, they are useful, and ought to be given to all, independently of their application to mathematical geography. To be able to explain rotation, the poles, and the equator, it is enough to make the learners familiar with the nature of *a circle*, *a sphere*, *a hemisphere*, *a diameter of a circle*, *a diameter of a sphere*,

and *a great circle of a sphere*; the latter being defined as "a circle on a sphere dividing its surface into two equal parts called *hemispheres*." This definition is sufficient; the other ("a circle whose plane passes through the centre") is too intricate. The teacher must then inform them that the map is a picture or representation of the round world. Cutting an apple in two, placing the pieces side by side, and turning the convex surfaces to the class, will, with a little explanation, be sufficient exposition, at this stage, of the representation of the earth's surface by the two adjoining circular maps. In dealing with this part of the subject it must be shown that, on looking at a sphere, we can see only half of it at once. These preliminaries being gone over, the next step is to explain that the world is in constant rotation, making one complete turn every twenty-four hours, and to lead them thence to the nature of the *axis*, which may be defined as *the diameter about which the earth rotates*. This is the only troublesome part of the teacher's work, and much explanation and illustration will be necessary to make the axis understood. Tops spinning, and especially when sleeping whilst turning, a coin made to spin round rapidly, a circular piece of paper with a diameter drawn, and made to revolve round it, will assist. It is unnecessary to dwell upon this: we have only to caution the young teacher not to point out the straight meridians (70° E. and 110° W.) as the axis (sad confusion is produced in the learner's mind from a line on the surface being pointed out as the axis); and, if he uses a wire through an apple, or thread through a paper, as an illustration of the earth's axis, to take care that some of his younger pupils do not suppose that there really is some such axis distinct from the earth's substance, which remains fixed, on which the earth is stuck, and around which it turns in a similar manner.

The axis of rotation being explained, the rest follows easily, being deduced from it by clear and simple steps. The *poles* are defined with precision as the ends of the axis; the *north pole* as the pole nearest to Europe; and the *equator* as a great circle round the earth, equidistant from both poles. The northern and southern hemispheres are then easily defined; and this is enough of definitions for a little. But it should be explained that the equator is really a *circle*, though it appears as a straight line on the map; that this is an error unavoidable in representing the round world on a flat surface, and that it is a circle on a globe; and, when the meridians and parallels come to be described, it should be shown also that they are semicircles and circles, the deviation from the circular curve being caused by the representation of a round on a flat surface.

Having thus defined the position of the equator, the teacher should next tell what is interesting about it; its length (24,897 miles); that day and night are *always* equal there, the sun rising at six and setting at six; that the twilight is very short, so that it is dark almost immediately after the sun has set; that the temperature there is nearly the same at all seasons; that that temperature is very high, 81° or 82° Fahr. (which can be explained by reference to our hot summer days); that the animals and plants there differ very much from those in Europe; that the sun is overhead there at noon about March 20 and

September 23 every year, when bodies cast no shadow; that at the equator the sun is never very far from being over-head at noon at any time of the year; that the pole star is in the horizon; the Great Bear near the horizon or below it and out of view; that the whole of the stars of the heavens may be seen there in one night, one half just after sunset, the other half just before sunrise; and we should not forget the alarms of the old navigators about the *burning line*, nor the ceremonies and tricks that Father Neptune practises on those who are crossing it for the first time.

These—expatiated upon and illustrated, and particularly contrasted with our own condition in respect to the different points—will excite great interest, and lead to numerous useful colloquies between teacher and pupil; and, what is of great importance, will suggest observation and thought on a variety of every-day occurrences that are neglected, because we are familiar with them.

The equator should then be connected in the pupils' mind with ordinary and physical geography, by pointing out, and making them point out the leading places it passes through or near. In doing so, it is well to go from W. to E. as the world rotates, and to begin at some notable point, as where the equator crosses the *first meridian*, which might now be pointed out; particulars as to its nature being deferred. The course of the equator would thus include the following places: it meets the first meridian in the Atlantic Ocean, just S. of the Gulf of Guinea, enters Africa a little N. of Cape Lopez, crosses Africa, enters the Indian Ocean, passes a little S. of the Maldive Islands, through Sumatra, a little S. of the British settlement of Singapore, through Borneo and Celebes, a little N. of New Guinea, through the Pacific Ocean, through the Galapagos Islands, enters South America in Equador, passes just N. of Quito, crosses New Granada and Brazil, and leaves that country and South America, and enters the Atlantic Ocean at the mouth of the river Amazon.

If the learners are often made to point out the course of the equator in this manner, or to watch others doing it, and sometimes to describe it from memory—not seeing the map—we fix in their minds important facts as to the positions of these places as regards the equator and each other, and their relations to the earth's rotation, to the solar influence, to the stars. In like manner, the learner should be made acquainted with the course of the following notable lines, as soon as the nature of each is explained:—Tropic of Cancer, Tropic of Capricorn, Arctic Circle, Antarctic Circle, the first meridian, the opposite meridian (180° E. or W.), and the parallel of the capital of the country in which he lives. Geographical instruction must be viewed as very incomplete that does not include a knowledge of the leading places through or near to which these lines pass. This at once fixes the position of these lines in the mind by the associations with which it links them; and the essential characters of these lines being known, gives important information regarding the towns or other places placed on or near these important lines. Also, the survey of the whole surface of the globe, obtained by learning the courses of these lines, assists greatly in fixing in the mind a knowledge of the forms and

relative positions of the leading continents and islands—a picture of the world, in short, which can be impressed on the mind only by frequently looking at the map.

The *fourth* division includes the subjects of *latitude*, the *tropics*, and the *torrid zone*. The preliminary definitions requisite are those of the words *parallel, small circle, parallel of latitude, meridian, degree*. The definition of parallel lines, that they are everywhere at the same distance, is preferable for geographical purposes. It should be distinctly pointed out that latitude must be measured along the meridian line, the line that runs north and south from each place; that every place on the same parallel has the same latitude: that the degrees of latitude are marked at the sides of the map; and that the length of a degree of latitude is 69$\frac{1}{10}$ English miles. When the pupils have been exercised a little in finding out the latitudes of notable places, and calculating their distances from the equator, they will know thoroughly the nature of latitude, and how to find the latitude of any place. Care must be taken to define a meridian as the *half-circle* from pole to pole—not as a whole circle, as is often done, which is very perplexing to the learner when he finds that there are two meridians in the complete circle. Every one should know his own latitude, what places are nearly on the same parallel, that those on the same parallel are in the same condition as to elevation of the sun, length of day and night, season, and that the number of degrees, &c., in his latitude, are the same as in the elevation of the pole-star above his horizon.

The pupil is now ready to have the tropics and the torrid zone explained to him. The former should be at first characterised as the furthest north and south parallels at which the sun is vertical, in order at once to associate that idea with them in the pupil's mind, their position, 23$\frac{1}{2}$ (23° 28′) N. and S. latitude, being subsequently explained. Then the torrid zone is defined as *the region of the sun's verticality*, lying between the tropics, and about 47° in breadth, and the learner should be taught, by aid of a simple figure, to view the earth's surface in two divisions—that in which the sun is vertical, and that in which he is never vertical. Then follow the times at which the sun is vertical at Cancer and Capricorn, the general condition of the northern and southern hemispheres at these times (longest and shortest day—warm and cold season); our own condition as to the sun's elevation in winter and summer—in the morning, noon, and evening (which is well illustrated by the varying length of the shadow), whence flows the general fact that the place and season are warmer the nearer the zenith (being vertical), which leads to the principal fact in the phenomena of climate. As already said, the leading places through or near which the tropics pass should now be pointed out, the tropic of Cancer being associated with many interesting places—passing near Havannah, between Mecca and Medina, near the mouths of the Indus and Ganges, near Calcutta, Canton, Hong Kong, &c.

The *fifth* division brings us to the important subject of *longitude*. It should at once be connected with time by the mention of the fact that all on the same meridian have the same time; that the time of

those on opposite meridians is twelve hours different. It should be explained that longitude is expressed in degrees, minutes, &c.; that it must be measured along the parallel of the place, the line that proceeds east and west from it; and that it is marked on the equator or on the top and bottom of the map. The notable places on or near the first and opposite meridians should be pointed out. The difference of time at different places may now be explained—15° for every hour, or 1° for four minutes (procured by dividing 360° by 24, or one hour by 15), the place to the *west* of the other being *behind* the time of the latter. Finding out places of which the longitude and latitude are given, and finding out the longitude, latitude, and time of given places, prove very interesting and instructive exercises, while the explanation of how the difference of time arises, and the proofs we have of this, in the different times of sunrise, even at places not very far east or west of each other, prove useful for developing thought. Either at this stage, or some early opportunity, the diminution of the degree of longitude, as the latitude increases, should be pointed out, and the learner should be taught how to calculate distances along a parallel of latitude by means of the table found in most geographical works, showing the length of a degree of longitude at different latitudes. Every one should thus find out the length of his own parallel, and know that that is the distance he is carried by daily rotation. Perhaps, also, every one should know the length of the degree of longitude at the equator, Cancer, London, and the Arctic Circle, which may be stated in round numbers as 69, 63, 43, 28 miles.

The *sixth* division embraces the subjects of *the polar circles*, the *polar* and *temperate regions*, and *day and night*. It is impossible to convey to the learner any precise or satisfactory knowledge as to these points, unless he has a clear understanding of the nature of *the terminator*, the great boundary line between night and day: a distinct conception of this line, and the frequent use of some simple term expressing it, are quite essential in the explanation of the phenomena of day and night at different times and places.* It will not be difficult to explain that the sun illumines only one side (or one-half) of the earth at a time; that the line between the dark and illumined parts is a great circle; and that *it must always be one quarter, or* 90°, *of a great circle from the place at which the sun is vertical*—the most important fact to bear in mind respecting the terminator. By means of it we at once define the polar circles, simply and shortly, as the parallels at the greatest distances of the terminator from the poles: it is easily shown that as the poles are 90° from the equator, the terminator 90° from where the sun is vertical, and the sun never vertical further than 23½ N. or S. of the equator, the terminator can never be above 23½ from the poles; just skirting the parallels at these dis-

* The lecturer was informed by a teacher that he had never before seen nor heard of the word *terminator;* he at once appreciated the value of such a term in explaining the phenomena of day and night, and was surprised that it should not be more generally employed in school-books on geography and astronomy.

tances from the poles when the sun is at his greatest distances from the equator. Besides its brevity, this definition is useful as pointing to an important fact relating to the condition of different regions as to day and night. The polar circles being thus defined, their course should be pointed out; that is, the notable places through or near which they pass, and the temperate zones, and polar or frozen regions, with their breadth in degrees, 43° and 47°, can now be explained.

Having now acquired a knowledge of the nature and position of the terminator, the learner may be instructed in some leading points relating to the phenomena of day and night at the same place at different times, and at the same time in different places. For this purpose, it must be made clear that our parallel of latitude is the path in which we move by the earth's daily rotation; and it will then be seen that the condition of any one as to day and night must depend upon the position of his parallel as regards the terminator. Now there are five different conditions in which he may be as to day and night: he may have equal day and equal night—long day and short night—no night—short day and long night—no day. If, during rotation, the terminator does not cross his parallel at all, he will then have no day, or no night, according as he is on the dark or illumined side of the terminator. If the terminator cuts his parallel unequally, his day and night will be unequal; if it cuts its parallel into two equal parts, his day and night must then be equal.

As the sun is never vertical further than 23½° from the equator, the terminator is never more than 23½° from the poles; hence it must always cut the parallels extending from the arctic south to the antarctic circle. This vast portion of the earth's surface, then, extending over 133 degrees of latitude, embracing the torrid and temperate zones, is distinguished by this—that during every rotation, there is both day and night, however unequal these may be. And as there are times when the terminator does not at all cut the parallels in the polar regions during the daily rotation, these regions are distinguished by this—that there are times when day or night continues for more than one rotation. Hence we have the twofold division of the earth's surface into the *region of both day and night during each rotation* (that between the two polar circles), and the *regions where day or night at times continue for more than one rotation* (those within the polar circles): and the pupil should be familiar with this view of the surface of the earth.

The sun being vertical at the equator at March 20 and September 23, the terminator then passes through both poles, or coincides with the meridian circle; hence it then cuts every parallel equally, and *at these times* (the equinoxes) *there is equal night and day all over the world.* As a great circle on a sphere cuts every other great circle into two equal parts, and the equator and terminator are great circles, *day and night are always equal at the equator.* As, when the sun goes N. or S. of the equator he does not return to that line for six months, so the terminator, when it passes from the poles, does not return to either of them for six months; hence, *each pole has six months day and six months night alternately during the year, from March 20th to Sep-*

tember 23rd. Hence we have the twofold division of the earth's surface into *regions of constantly equal day and night* (polar, six months each, equator, twelve hours each), and *regions of unequal day and night* (the other part of the earth's surface).

As the terminator gradually recedes from the poles, the number of parallels which he does not cross increase, till he reaches the polar circles; hence, *from the equinoxes a gradually increasing portion of each polar region has constant day or constant night, the maximum being at the solstices, when the whole of each polar region is in one or other of these states.* As after the equinoxes, the terminator diverges from the line of the meridian circle and cuts all the parallels unequally; *day and night are unequal between these times, the maximum of inequality being at the time of the solstices.* Hence generally, *day and night are more nearly equal as the place is nearer the equator or the time nearer to an equinox.* And as, when the terminator crosses the poles, it lies on opposite sides of the meridian circle, reckoning from the equator; *the northern and southern hemispheres are always in exactly opposite conditions as to the length of day and night.*

In every school, the attention of the pupils should be invariably called to the solstices and equinoxes, when these periods recur: on each of these four days they should tell or be told on what line, and at what notable places the sun is vertical; how the terminator lies; where continual day and continual night are beginning or ending, which pole has its sunrise or sunset, its mid-day or midnight; which hemisphere is entering on its period of long days, which of short days; which has its longest, and which its shortest day, and so on. Singling out these four days, and discussing the phenomena characteristic of each, assist greatly to fix them in the mind.

The interesting and important points in mathematical-geography, which have thus been hastily sketched, are entirely omitted in many schools; and even where some attention is paid to them, they are taught in too isolated and abstract a manner, not brought home to the learner by being associated with phenomena in his own condition, or with places of interest in the various countries. By proceeding gradually, introducing the necessary definitions by degrees, and during the whole of the lessons, connecting the various lines and zones with the notable places, nations, &c., on or near them, the teacher gives a living interest to the subject, and makes his pupils well acquainted also with the general physical features of the earth's surface: for they are obliged to survey frequently the whole of the map of the world in naming the positions of leading places, as regards the several lines and zones. While making his pupils thus acquainted with the actual relations of the different parts of the surface of the earth to the solar influence, the teacher should, when there is time for it and a class capable of understanding it, explain also the astronomical causes that place the earth and sun in the successive positions that give rise to this phenomena—the inclination of the earth's axis to the plane of the orbit; the annual orbitual motion round the sun; and the parallelism of the axis in all parts of that orbit. This can be explained very well, without entering into the subject of general astronomy.

In numerous cases, it will be impossible to attempt such explanation; nevertheless, let them have the phenomena as facts of interest in geography, even where there is not time to instruct in the physical causes of them; but let the learners be distinctly cautioned that the reasons have not been explained to them, and directed to bear this in mind, and to seek for the reasons the first opportunity that occurs to them. This is of importance—it excites thought and speculation, discourages the formation of the habit of being content with phenomena without searching for their causes, and at once stimulates the desire for further knowledge, and prevents that conceit that is apt to arise in the mind which thinks that it knows all that is to be known.

There are four primary or fundamental elements in the physical condition of any region: its relation to the solar influences; its elevation; its position in respect of large masses of land and water; and its geology. These four mainly determine the climate, the prevailing plants and animals, capacity for cultivation, manufactures and commerce, and general condition of the inhabitants. Of these, the action of the sun's rays is certainly one of the most powerful. If we wish, then, to present a complete view of the natural history of any region, and of its capabilities, we must regard as an essential part of its geography a knowledge of its relation to the solar influences, the great prime movers of the phenomena going on at the surface of our earth.

ON THE TRAINING SYSTEM OF EDUCATION, PARTICULARLY AS ADAPTED FOR LARGE TOWNS.

By WILLIAM KNIGHTON, M.A., M.R.A.S., *Lecturer on Education in Whitelands Training Institution, Chelsea; Author of "Tropical Sketches."*

THE lecturer began by stating that Mr. David Stow, of Glasgow, was prevented by illness from explaining the system, to the establishment of which he has devoted his life and fortune for the last thirty years.

In superintending Sunday-schools, between 1816 and 1821, the founder of the training system was first led to inquire into education, and particularly into the reasons why teaching in Sunday-schools alone, when unaccompanied by other education, was so ineffective. He was led to believe, after much investigation of the subject, that the influences at work upon the child out-of-doors were more lasting in their results because they were not simply *teaching*. The principle of imitation common amongst all mankind was to be partly charged with this result. Children like to resemble those with whom they associate, just as men do. This influence—"the sympathy of numbers"—is powerful for evil in lanes and alleys; why should it not be made powerful for good in schools? The proper means by which it is to be so made powerful for good in schools were by no means easy of discovery. Teaching alone will not do, there must be more than teaching. The word *training* was introduced into education by Mr. Stow, and it was received with a storm of ridicule from many of the most eminent educationists of those days—it reminded people of "dogs and horses," and very merry were they made by its application to children.

Like many other difficulties, however, that was surmounted, and *training* is no longer regarded as an absurdity when used to designate the way in which children should be prepared for future life. The greater part of the instruction given in those days was addressed to the memory alone. Not only in the more elementary schools, but in those of a classical and collegiate character, the memory was almost

exclusively cultivated to the neglect of all the other mental faculties. Even such helps to memory as the association of ideas, the analytical and synthetical powers of the mind, and the faculty of imagination, were seldom addressed, and never systematically exercised or cultivated. The *method* was altogether wrong, and the first step made by the training system towards the improvement of method, was the introduction of a large proportion of oral instruction into the ordinary class-work, simultaneous being mingled with individual lesson-giving, and the subjects taught illustrated from all the features of nature or operations of man, open to the observation of the children. To this method of suggestion, of illustration, of enlisting all the mental faculties to aid the memory and the attention, the term of *picturing out* was applied—not a very happy term, perhaps, but still one that is sufficiently precise to convey some idea of its meaning to the hearer.*

Training, in contradistinction to *teaching*, would develop all the powers of the mind harmoniously,—the observing faculties, comparison, imagination, judgment, and the moral sentiments altogether, —not by simple admonitions, or by addressing the intellect only, but by outward appeals, appeals to the senses, by the visible, the external, the tangible; by imitation too, suggestion, and all the various modes in which the sympathy of numbers can act upon children. To accomplish this a large proportion of oral instruction was introduced into the school routine, simultaneous methods developed, a playground attached to the school premises, and a gallery erected in it for greater convenience in giving simultaneous lessons. These simultaneous lessons form the great means afforded by the training system for the *intellectual* development of the pupils, and that part of the system, too, to which perhaps the most objection has been made. This objection has probably been often made in consequence of a misapprehension that has prevailed, to wit, that the training system requires all subjects to be taught simultaneously. Nothing can be farther from the truth. All the training system aims at is a judicious combination of individual and simultaneous instruction, nor does it give any particular method as that by which arithmetic, geography, and the other branches of elementary education may alone be efficiently taught.

We are all aware that if we would strengthen the muscles of our bodies we must use them, we must exercise them again and again, and the more they are so used and exercised, within the limits of health, the stronger will they become. It is precisely the same with the mental powers. Every one will admit this fact, yet in education it is often completely ignored. If we make a child read a lesson upon coal, its memory may be stored with many useful truths—a languid interest even may be awakened occasionally, in the progress of the lesson, by the facts narrated. But if we present a piece of coal before them and require them to discover its qualities for themselves, their attention is at once secured, their powers of observation are awakened,

* See "The Training System," 10th edit., pp. 190—200; and again pp. 244—253.

their senses, the outworks of those powers, are all brought into active exercise. The properties discovered, if we proceed next to the method of obtaining coal and the localities whence it is obtained, other powers of the mind are still constantly brought into harmonious exercise. Recollection invites the memory to search its store-houses for facts previously learned on the same subject—*association* recalls the accounts heard or read of iron, or lead, or salt-mines—*conception* aids the *imagination* in picturing the appearance of the mine, with its dark shafts and blackened miners, dimly seen by the flickering lights. Where coal is obtained in the greatest abundance, may be pointed out upon the maps, always interesting and attractive to children if properly used; and, lastly, the higher moral powers may be awakened into exercise to tell how we should feel towards the Author and Giver of all Good, who has blessed our island with its stores of mineral fuel. In such a lesson, if properly conducted, all the powers of the mind are successively brought into healthy exercise; and any schoolmaster, who has been trained to practise his profession for two or three years, may easily give such a lesson to masses of children, varying from twenty to eighty, or ninety, in number.

In the giving of simultaneous lessons on the elements of science, and on common things, by means of questions and ellipses, Mr. Knighton showed by the above example how all the powers of the mind might be brought successively into exercise, and how the analytical and synthetical habits of thought, the method of suggestion and illustration—"picturing out," in fact, as it is called—may be made available, to awaken and maintain the attention. In such oral lessons, whether scriptural or secular, the children should be prepared to give the lesson, the deduction, the grand final truth, towards which the rest of the exercise is but the path that leads the children.

It was explained that the training system by no means demands an indiscriminate aggregation of children of various ages and at various stages of progress. It requires that the children should be as nearly as possible of the same age, and as nearly as possible at the same stage of improvement—the more nearly in both cases the better, because "the sympathy of numbers" is more powerful and influential when such is the case. Nor does the training system propose simultaneous instruction as a cheap substitute for individual instruction—it requires a judicious combination of both as its fundamental principle.

Some of the practical difficulties, experienced in the giving of such lessons as the training system demands, were then noticed, together with objections answered; whilst the lecturer referred to his own experience in England and India in proof of the intellectual benefits of the method.

The point of most importance, however, in the system, and that which best fits it for large towns, is its endeavour to find a suitable antidote to the evil training of the streets and lanes—its method of moral training. These may be regarded as the characteristic features of the system. In the play-grounds, argued Mr. Knighton, children will exhibit themselves such as they really are. Their good or evil

dispositions, their excellences or their defects, will show themselves when the discipline of the school-room has been shaken off, and the individual existence of each child is no longer merged in the aggregate of the school. By mingling with them in their hours of play, the teacher becomes acquainted with the peculiar faults into which each is most liable to fall; he checks impropriety and the exhibition of vicious temper. The restraint is at first felt to be irksome by the vicious child, but is gradually succumbed to, and what was done with a violent effort at first, is soon accomplished without inconvenience. New habits are formed, old ones are discarded; the vicious child recently introduced, is taken as it were from one atmosphere, an atmosphere of pestilent vice, and now breathes another, an atmosphere of morality. The same sympathy that would make that child morally vile in its native lane makes it morally excellent in the well-conducted school. But the influence of the playground does not end here. The teacher, noting what takes place there, may refer to it in his Bible lessons, bringing texts to bear upon particular faults or vices observed, and showing offenders how they have transgressed the law of God in their uncharitable conduct or in their displays of selfishness. The playground may be made also a field for the exercise of self-denial, by the cultivation of fruit and flowers round its borders, which the children should be trained to care for and look after, but not to steal. If there be any class upon whom it is imperative to exercise self-denial, that class is the very poor in large towns and their neighbourhood; hence the necessity of beginning early with them.

But it may be argued that, however desirable all this may be, it is impracticable. Not so. In country villages and the suburbs of large towns, a play-ground is easily secured. In the midst of densely-populated cities, however, although a piece of ground adjoining the school-premises may not be procurable, yet the building itself may be so constituted as to contain in itself all that is necessary. For instance, a school or schools—say two schools, an infant (initiatory) and a juvenile—may be raised on arches open at both sides to the air, these arches serving as a play-ground for one school; whilst, by means of a flat asphalted roof, with a lofty substantial parapet, another play-ground may be provided for the other school. Elevations and ground plans of such buildings will be found, it was observed, amongst the plates illustrative of the working of the training system, which lie upon one of the tables in the exhibition.*

The advantage of having male and female children educated in the same infant and juvenile schools, is a point upon which Mr. Stow has long insisted. Experience goes to confirm the wisdom of the advocacy. There is so little efficient training of any kind in the families of the very poor, and what the children learn in the streets is generally so injurious, that it appears to be the only means of bringing up these boys and girls to act correctly towards each other in after life. If they are so to act, their moral school training cannot begin too soon. The rudeness and reliance on physical strength natural to boys may there-

* Also in "The Training System," 10th Edition, plates 17 to 20.

by be softened and polished, whilst the affectation of too much sensibility, which would unfit girls for their subsequent laborious life, and which is likely to be fostered by their being brought up exclusively with girls, may thus be made to yield to greater fortitude of character and a braver meeting with the evils and trials which all must endure more or less. I speak, said the lecturer, of elementary teaching, and of that class of children usually educated in our national schools.

By giving intellectual education simply to children, we give them a powerful instrument which they may use well or ill as they please. As much intellectual acuteness may be displayed in picking pockets as in solving the most complicated problems of algebra. Unless religious and moral training be united with intellectual, evil may be the result. The mind itself may be enlightened and rendered more capable of exertion, but the direction in which it shall be exerted may be evil instead of good—nay, rather will probably be evil; for the simple increase of knowledge is by no means friendly to content. It increases the desires, it expands the hopes, without giving either the material or the spiritual requirements to satisfy them. Its tendency is rather to urge us *from* the present and the actual, to drive us into a headlong chase after that which might have been, but is not: and, in that chase, how many must fall, bruised and wounded, to be trampled on by the more fortunate, and to rise enemies of society and of their race.

Thus, then, for the religious and moral education of the children, the training system provides, in the first place, lessons from the Bible; oral lessons, combining simultaneous and individual instruction, and consisting principally of questions to be answered, and ellipses to be filled up by the children, they having the Bible in their hands, and referring to passages and texts, as may be required. In the second place, the moral superintendence of the children by the master or mistress in the play-ground—a superintendence consisting principally of observations and familiar intercourse, mingling in their games, directing them occasionally by an admonitory look or word, but at the same time taking care not by any means unnecessarily to interfere. And, in the third place, the subsequent review of their conduct in the play-ground, and the gentle hinting at evil dispositions exhibited in an oral training lesson, or the quiet reproof of more open faults, constitute the means which the training system puts into our hands for training children religiously and morally.

Intellectually, again, the education is completed by that awakening of the faculties, that bringing into constant action of all the powers of the mind, which has formerly been described as the result of such lessons on the elements of science, and its adaptation to the purposes of ordinary life, as are intended daily to be given to all the classes in the gallery.

But the object of the training system is to combine *religious* and *moral*, and *intellectual* training with *physical* development. This latter is provided for in the play-ground, where a pole, with a few ropes attached, a bar or two of wood, and a number of wooden blocks, representing bricks, will suffice to give amusement, and to make the

play-ground attractive and delightful, to a hundred children. But, it has been urged, if the children be under *surveillance* all the time, and aware that they are so, their amusement must be constrained and unnatural. Experience proves the reverse—the experience of every one who has given the method a fair trial. A highly vicious boy, introduced into a well-trained school, will at first find this superintendence irksome and uncomfortable. He sees the teacher's eye frequently fixed upon him, and he shrinks from it—he would act differently from the others, if he dared. But the sympathy of numbers tells upon him very soon. That which was at first done with an effort, becomes gradually a second nature. Old habits are worn out, discarded, forgotten. New habits are formed, new methods of action and of conduct embraced; not all at once, of course, but gradually, slowly, surely. Superintendence is thus no longer irksome. He scarcely remembers that he is superintended—never indeed, perhaps, except when sudden anger or a vindictive temper would lead him to revenge, by summary punishment, some fancied or real wrong. These bursts of temper, if they do not lead to outrageous conduct, the teacher will do well, perhaps, sometimes not to see at all—to pass them over without notice, or at all events without further notice than a look. The moral tone of the school will do its work in time, and the vicious boy will adapt himself to the atmosphere of the place. Hence it is that we believe the system so admirably adapted to ragged schools, and to such industrial institutions as are supplied with children from the workhouses and poor-houses. Without a play-ground, however, and regularly trained teachers, it cannot be thoroughly or efficiently worked out.

"I have thus endeavoured to point out how the system provides for the *religious* and *moral*, the *intellectual* and the *physical* training of the children," remarked the lecturer.

He then proceeded to contrast the teacher's office, such as it *was*, with what it *is*, pointing out particularly the effect of the training system in making it a more happy, hopeful employment than it ever was before.

"I have had ample opportunities," said he, "of becoming acquainted with the peculiar joys and sorrows, the peculiar lights and shadows of the teacher's office, and I have had, too, throughout a somewhat varied experience, frequent opportunities of comparing it with the employments of other men. My conviction is, that a school properly conducted on the training system, is the source of much pleasure to a well-constituted teacher; that every school, properly conducted, on any of the improved methods which have been springing up of late years, should be a scene of happy, hopeful labour to all connected with it. Nor is there more of monotony in school routine than there is in the practice of any other profession. The lawyer, the physician, the merchant, the artist, and the author have all to do the same thing over and over again, incessantly. It is a law of the life of humanity which cannot be evaded. We are born to perform the same actions, to experience the same sensations, to undergo the same trials and fatigues again and again constantly, and there is not

more of this constant iteration in the teacher's office than in any other. It is my honest conviction that the swinging, the marching, the oral lessons, the play-ground exercise, and the simultaneous answering, characteristic of the training system, render the office of the teacher much more pleasant and lively than it could otherwise be."

Mr. Knighton concluded with a few statistical facts, showing the rapid extension of the system, and with a short account of the ordinary routine adopted in those schools which have taken their method and system from the Normal Seminary in Glasgow.

ON THE INSPECTOR AND THE SCHOOLMASTER.

By W. A. Shields, *Master of the Peckham Birkbeck Schools.*

That there has been a great improvement effected within the last few years in the education given in our common schools, is a fact to which the experience of all present will enable them to testify. For this improvement, both in the schools under Government inspection, and in others which, though not under the control of Government, have yet nevertheless been influenced for good by what has been going on around them, we are mainly indebted to the arrangements and operations by which the Committee of Council on Education have sought to improve our National and British Schools. But it is evident we are still advancing. The position, with regard to general education, now taken by the Society of Arts, and the efforts that are being made by that body to assist and extend our Mechanics' Institutes, are facts as remarkable in the history of education in this country, as they are creditable to the Society of Arts and remarkable in its history. The thoughtful observer will have noticed, too, how completely the more intelligent friends of education, in their recent efforts, have ceased to regard mere instruction as education. The Dean of Hereford's successful efforts at King's Somborne, to introduce into a village school the highest kind of teaching, the publicity given to that effort, and the warm approbation expressed by the Rev. Inspector Moseley in his report of it;—the attempt made by Lord Ashburton so to influence the training of masters that they may in future go forth to their work able to illustrate the great fundamental laws of physical and economical science by lessons on those common things the very commonness of which gives them so great an interest in the eyes of children; all point to the fact that henceforward it will be expected that our schools shall be made the means of so disciplining the intellects and forming the habits of children, as to fit them for entering with every probability of success on the duties of life. And this view of what is the tendency of the causes now at work forming public opinion on the question of education is strengthened by the character of the questions recently put to candidates for the Ashburton prizes. Besides such questions as "Which is the best tea-pot?"

"And why?" the examiners asked, "What are the conditions of industrial success?" "What do you find wanting in the homes of your children?" "How is your school work tending to supply the want?"

These circumstances seem to render it desirable, that before the close of this Exhibition, we should have under our consideration the men who are really at work carrying out these views, and for this purpose it is proposed to-night to investigate how the inspector and the schoolmaster are doing what is confided to them, and how they may most effectually co-operate in their work. Every one who has received visitors in his school, will have been struck with the remarkable difference which is to be observed even between men who style themselves friends of education. One man enters your school, and you perceive, as it were, at a glance, that, for want of correct principles to guide him, he is incapable of forming a just judgment of what you are doing. His questions are frivolous, his whole attention is directed to matters of trifling detail; he is great on some question of school-fittings, or he has perhaps strong feelings in favour of some new system of teaching reading, not that he has seen the system in operation, but, as you discover by your cross-examination of him, he has seen it favourably *reviewed*. Any effort on your part to attract his attention from the mere form of the school-work to the matter of it, fails. He did not come to learn. He has no notion that the schoolmaster is capable of directing *him*, and he resents the questioning to which you have subjected his views by curtailing his visit. You are glad to see him go, and say to yourself as he leaves, "there's a man who would not do for an inspector."

But another friend of education visits you. The first step in his examination is to hear you teach. He watches the lesson with profound interest. The thoughtfulness displayed by the children in their answers, and the process of mental discipline which he detects in the way the children are led to correct their own false conclusions, strike him as very important characteristics of the school. He reads, in the intellectual habits of the boy, the intellectual history of the man. At the close of the lesson, he questions some of the children, and as they evince their knowledge of the *principles* of the subject on which they are questioned, he remarks that the childishness of the language is unimportant. He has observed that children *know* long before they can, in poised and connected sentences, express their knowledge; and he has observed also, that the glibly-recited catechismal answer is no evidence whatever of the possession of knowledge. Even the mistakes of the children interest him. Some question which you put for the very purpose of eliciting an erroneous answer, that the error might be examined and corrected, arrested his attention. He traces, step by step, the means by which the error was discovered and the truth arrived at. The readiness with which the wrong conclusion was given up, and the eager intelligence with which the truth, as it came to light, was seized upon, delighted him, for he sees the work of mental and moral discipline going on. *He* can see what you are doing. But he has some difficulties with regard to your course, and he names them.

You, too, have had these difficulties. You explain to him how you have overcome such as you feel you have overcome, and how you are attempting to master those with which you are still but struggling. The discussion does you both good. You get a look at your school work from a new point of view, and your visitor gets his belief in the power of education enlarged and strengthened; and as he leaves, expressing his earnest sympathy in your efforts, you feel that his praise re-invigorates you for your work, and say, "Now there's a man who, whenever he shall have become well acquainted with the mere technicalities of school duties, would make an admirable inspector."

With these outlines of character before us, we might proceed to criticise, as they represent themselves in their reports, the men to whom the duty of inspection has been confided; but it is not our intention to-night to treat, otherwise than in a very general way, of this part of the subject. We recognize that if schools are to be assisted from the public purse, the public must have the means of ascertaining that the object for which the assistance is given, is, as far as may be, effected; and we believe that, considering all the circumstances of the case,—that the appointment is a Government one; that the gentlemen appointed are nearly all clergymen, having no other special requisite for the office except mere scholastic education; that the large claims made by the normal school authorities have considerably embarrassed the action of the Government; that in the outset there was a strong tendency in travelled men to introduce among us continental crotchets, without asking how far the influence for good of any scheme of continental education was superior to, nay, equal to our own;—considering all these circumstances, it must be acknowledged that, both in their examinations of the schools and in the discussion of educational questions in their reports, the doings of inspectors on the whole reflect considerable credit upon the Committee of Council. And we shall be prepared to dismiss this part of our subject by saying that we feel it to be the duty of every schoolmaster, receiving the Government aid, to welcome the visit of the inspector, and to receive him in the spirit of frankest honesty. In the event of anything being wrong in the school, (and we all know what a tendency there is even in the best managed school, for some portion of the work to slip from under notice and so to get neglected,) the schoolmaster should rather point out, than leave the inspector to discover, the neglect. Such openness will give the schoolmaster the best opportunity of explaining the cause, and give the inspector the strongest hope of the cure, of the evil. On the other hand, we think that no inspector can be held to deal fairly by the schoolmaster who does not seek to look at the school from the schoolmaster's point of view. It is not intended by this to impugn the right of the inspector to form his own independent judgment on what he sees, on the contrary, we affirm *that* to be especially the inspector's duty; but in observing the facts on which his judgment is to be formed, he will be vain and unjust if he refuses the help that can be given to him by the person best of all acquainted with the school—the schoolmaster. Probably to the neglect of this gentlemanly intercourse between the inspector and the schoolmaster are to be attributed such specimens of reporting as follow:

"Gave a sum in long division to the division class, consisting of ten boys. Three returned the right answer, seven wrong ones." "Well," we say, "evidently this is not meant for praise, but where is the ground for censure?" "Don't you know that these boys form the long division class?" *i. e.*, are arranged here to learn division simply because they can't do it. "If they could off-hand all produce the correct answer to your question, it would be the best evidence you could offer that they were misemployed." But to the report again: —"Heard the teacher explain a subject to the class. The great bulk of the answers in the first instance were given by the cleverest and most forward boys." "Well," we say, again, "and what ground for censure does your report set before us? Don't you know that boys are not all equal, and that fortunately no school system can make them so?—that the most intelligent do first perceive what the teacher is driving at, and that they who first perceive, are likely to be the first to answer?" True, there may have been much wrong in this class. The slower boys may have been neglected, and in that case the inspector would do right to point out the neglect, but no such fact appears on the face of the report just cited. There, censure is implied, but no ground of evidence furnished as to why it is deserved, for the common, nay, the vulgar error, that the boys not answering are not instructed by those who do, is one into which we would fain hope the inspector in question had not fallen, or, if he had, we have no hesitation in saying that an explanation from an intelligent schoolmaster of how the brighter intellects of the school, seizing with avidity on a new truth, and construing it, so to speak, into boyish phrase, act upon and stimulate the duller minds, would soon have made him a wiser and an abler examiner. But these instances are both taken from an old report. Better things are being done now, and so, expressing our pleasure at the good that has been achieved and our hope in the arrangements for the future, we turn to what to us must be the more interesting portion of the subject—the schoolmaster—his work—and how far he is efficient for it.

We have already had occasion incidentally to advert to what is now demanded from the schoolmaster. No longer is he to consider his duty that of merely giving a little instruction. Reading, writing, arithmetic, with perhaps the addition of a little grammar, geography, and history, no longer express his work. Nor do these, set as tasks for the children to learn by rote—which tasks he is to hear duly repeated and re-repeated—any longer express the mode in which his work is to be carried on. All that has been attempted in schools is still required, and required of us better done; nor do we think that any schoolmaster who is worthy of his calling would ask, or would wish, that in this respect, a lower tone should pervade the public mind. But, besides and beyond all these things, the schoolmaster is now expected to give such instruction in physiology as will make a boy well acquainted with the general laws of health, and such instruction in natural philosophy as shall enable him to perceive the principles upon which are constructed, and by which are managed, the various machines in daily use around us; such instruction in chemistry as shall cause the various applications of chemical science in the arts

to be no mystery to the artisan who superintends them; and such a knowledge of natural history as shall expel the dragon and the unicorn from popular belief, whilst it makes the fragments even of extinct races of animals disentombed by the geologist, and arranged by the comparative anatomist, subjects of deep interest and of intelligent delight. Further, the weighty evils that afflict society, when every now and then men bent on raising their wages take precisely the means to lower them, when men seeking to lower prices take precisely the means that tend to raise them, have arrested attention: all feel how helpless is the most logical reasoning in the midst of the passions aroused by these social struggles; how terrible is the lesson of want which drives the unionist to desert the strike and seek again, perhaps ineffectually, the labour he had refused; how utterly shocking the fact that the strong authority of the law, in the prison or at the bar, gives the first lesson that shakes the rioter's faith in the righteousness of his efforts to lower the price of bread; and, turning to the schoolmaster, the public voice demands that what some are doing to cope with these evils all shall attempt. Nor by task-work is this to be attempted. The schoolmaster is not to set the boy the task to learn, but himself the task to teach. It is expected of him that he shall be able to beget in the boy's mind a longing after knowledge, making the getting of that knowledge its own great reward, that he shall so thoroughly master his subject as to be apt at illustration, and able to present to his pupils "*prerogative*" instances in the richest abundance which the subject will furnish; that whilst doing all this, and far from negligent as to the quantity of knowledge imparted, he shall yet hold *that* as secondary to the great work of forming the judgment, disciplining the intellect, and training the morals of the boy throughout the whole of his school course.

But it may be said, who is sufficient for these things? and at once we may as well acknowledge that we do not feel ourselves strong—that we wish we were more able—an acknowledgment that will perhaps most readily be made by the very men who are most strenuously struggling to render themselves efficient. Some knowledge, a respectable amount of it, we have; and of late have done much to increase our stock, for in that way of late have all educational influences been tending. The Normal School has extended its curriculum; the Committee of Council continue to increase their demands, and so far well; but the mere possession of knowledge does not imply power to teach, and it is in regard of teaching power that we acknowledge our deficiency, and complain that little has been done for us. Not that in complaining we would be thought to censure the Normal Institutions. We know too well how great the task, and how inadequate the means of those Institutions have been, and we regard it as a fact, that after all is done that Training Schools can do, the chiefest and best training a man receives is the self-training through which he puts himself in his daily work. In most cases, on leaving the Training School, the schoolmaster needs must be a raw teacher, but if he be true to himself and his duty, he will go on rising to be a ripe one.

And this brings us to consider the question of teaching. Let us first take a specimen of good teaching. Appended to a lecture delivered at the Royal Institution, by Dr. Whewell, on "The Influence of the History of Science upon Intellectual Education," is a specimen of teaching, extracted from Plato. Those who have seen the specimen will not be sorry to have it referred to, and those to whom the reference may be new will not regret having been led to examine the lecture and note for themselves. As we have a very different object to serve to what Plato had, we need not quote verbatim. Our business will be, not to show that those who do not know have still in their minds a latent knowledge, but to note how a boy may be taught as it were to discover for himself, under the guidance of a competent teacher, the length of the side of a square whose area shall be double that of a given square.

Socrates asks, Do you know that this is a square?

Boy.—Yes.

Socrates.—Why?

Boy.—Because the four sides are equal, and the lines which are drawn across the middle from corner to corner, are equal.

Socrates.—May there be a square twice as great as this?

Boy.—Yes.

[Thus far we have elicited knowledge already possessed, and refreshed the boy's memory.]

Socrates.—How long must one side of the new square be that its area may be twice as great as that of the old square?

Boy.—Twice as long as the side of the first square.

[Here we have brought out for us the error—a very common one, as you all know—now for the teaching-skill in making the boy detect the error.]

Socrates.—So you say the square on a double line will be the double of the first square? Now, let us fit to one end of the first square a second square which is equal to it. And let us fit two other squares of the same size to the sides of those two squares. Then what figure have we?

Boy.—A square.

Socrates.—And how many times as great as the first square is it?

Boy.—Four times as great.

Socrates.—Not twice as great, as you said?

Boy.—No; it is four times as great.

[Thus is the error exposed, the boy being thoroughly convinced; now for the teacher's guidance in the discovery of the new truth.]

Socrates.—If in this new square, which is made up of four of the old squares, we draw four diagonals, so as to cut off the four outside corners, each of these diagonals will cut each of these squares, how?

Boy.—Into halves.

Socrates.—And you already know that these four diagonals will be equal, and will form another square?

Boy.—Yes; I know.

Socrates.—And of what parts of the four squares is this inside square made up?

Boy.—Of the four inside halves.

Socrates.—And four halves are equal to what?
Boy.—To two wholes.
Socrates.—Then we have got a square that is equal to how many of the original squares?
Boy.—To two of them.
Socrates.—And it is a square upon what line?
Boy.—Upon the line that divides the original square into two halves.
Socrates.—That is, upon its diagonal?
Boy.—Yes.

Surely no one can have failed to see that in eliciting the error, in correcting it, in discovering the truth, the boy's mind was being put through a course of discipline most salutary, and it will be hardly possible to doubt that the boy thus taught would be ready of himself to go over the steps of the proof again by himself, and to turn at his leisure to any other form of proof of the propositions that might fall within his reach. At the same time, the practised teacher will have suggested to his mind many other useful hints which this lesson could be made to furnish—that this is a special case of the celebrated 47th proposition, the right angled triangle here being isosceles—that the square of a half is a fourth—the square on the double of a line or of the double of a number is four times the square on that line or of that number—that $(2a)^2$ is not $4a$ nor $2a^2$, but $4a^2$, &c., &c.—and he will perceive also how connecting together these similar instances will give the boy a power of remembering them too, such as mere rote-work can never confer.

But let us turn now to some bad teaching. The extracts shall be from the "Guide to Science," by the Rev. Dr. Brewer, of Trinity Hall, Cambridge.

"*Q.*—What is light?

"*A.*—Rapid undulations of a fluid called the luminous ether, made sensible to the eye by striking on the optic nerve."

"The several particles of which air is composed do not touch each other. It is assumed that the intervening spaces are occupied by an imponderable medium, called the luminous ether."

To say nothing of the doctor's audacity in endeavouring, in the present state of our knowledge, dogmatically to answer this question, think of telling a child who has seen sunshine, or who has cried for a light in his bed-room, that light is a rapid undulation of luminous ether, and this, too, under the guise of instructing him!

Could we mean by teaching, the making of that doubtful and difficult which was before comparatively easy and plain, or the creating of ignorance where we found knowledge, we have here evidently hit upon a book that will marvellously well help us, for the questions,

What is heat? What is radiation?
Why does lightning purify the air?
Why is electricity excited by friction?
Why is ice melted? &c., &c.,

all questions which the competent instructor in science, just because he is competent, would shrink from answering dogmatically, are handled in the same style by the doctor—are bathed not in the li-

"*Q.*—What is the safest thing a person can do to avoid injury from lightning?

"*A.*—To draw his bedstead into the middle of the room, commit himself to the care of God, and go to bed, remembering that our Lord has said, 'The very hairs of your head are all numbered.'"

"N.B.—No great danger needs really to be apprehended from lightning, if you avoid taking your position near tall trees, spires, or other elevated objects."

We do not propose to complain here of the unnecessary fright into which the boy may be thrown by this answer, nor shall we stay to inquire whether the doctor does, in every thunder-storm, wheel his own bedstead into the middle of the room and go to bed. Even the religious injunction we can scarcely stay to criticise, though the doctor, as a religious teacher, should have seen that an injunction given in such a way influences children to regard the committing of themselves to the care of God as a work to be done in seasons of danger rather than as that habitual state of mind which we are sure he desires to produce; but we go at once to the conduct of the doctor's own understanding. It is plain, having got the boy to bed in a fright, the doctor feels, with us, that this part has been overdone—he desires to soothe the sufferer. Hence his Nota Bene. But mark, had he written, "No danger needs be apprehended from lightning," the contradiction between the answer and its appended note would have been too plain, even for him, for the human mind will not endure to receive two contradictory statements as both true, when the contradiction is thus evident. He proceeds, then, not to get rid of the contradiction, but to obfuscate the whole matter, and he does so by putting in the word "really," which has really no business in the sentence, for danger to be apprehended is danger really to be apprehended neither more nor less. Even the doctor felt he was not dealing with sham apprehension.

How far the spirit of Plato or the spirit of Dr. Brewer rules in the teaching in our schools, is a question which, though not requiring a public answer here to-night, it surely is important for each teacher to put to himself, and answer for himself; and fairly may it be hoped, when we remember, how industriously a large proportion of our number are seeking self-improvement—a fact which the large attendance of teachers in this Hall on every occasion of a practical question being

himself he needs not an accurate and painful acquaintance with even certain branches of physical science, but such an acquaintance with science in general and with its method—for there is but one—as will enable him to lay under contribution for school use those riches of science in all its branches which the devoted disciples of each branch gather for the general use of the intelligent portion of mankind. But, says the objector: What *is* the schoolmaster to do? Has not each lecturer here shown that his branch is *the one* to be studied? Who is to decide? We answer, the schoolmaster himself is to decide. He is to remember that in this respect, as in some others in relation to his boys, he does stand *in loco parentis*. *He* is to decide, and to be very careful to decide wisely. Perhaps in a rough way his duty may be indicated thus: It is not expected of him that he shall be intimately acquainted with all the organic radicals known to the chemist, that he should be read in all the questions in dispute amongst physiologists, or that he shall off-hand name each mineral, each plant, or each shell that may be placed in his hands. On the contrary, the feeling amongst intelligent minds, especially, is, that the devoting of himself to any one branch merely, and as a whole, is a profound mistake. No schoolmaster, perhaps, is really less than he who affects to be great on—it may be—a little conchology. But it is expected of him that he shall be at least striving to attain, say in chemistry, so much skill in experiment as shall enable him to illustrate his lessons well, and so thorough a command of the principles of the science as shall enable him from his experiments to teach the law of chemical equivalents,—the great law of chemistry; whilst, as regards the atomic theory, it is expected he should be able to discover exactly why it still is theory only, and not knowledge; and also, in putting this before his boys, that he should be very skilful in making them detect what absolutely they do know as opposed to what, on the strength of mere deduction, they have plausible evidence for believing. Similarly with physiology, with biological science in general, with geology, &c., it is this attention to a mastery of the leading thought and main interest and chief aim of the science with which the schoolmaster has to do. "But," says the objector again, "do you mean to make the schoolmaster a mere superficial student?" No such thing. Thorough acquaintance with the *principles* of a science imports anything but superficiality. Much more truly may the man of detail, who cannot use his details for the purpose of generalization, be regarded as the superficial man. But the truth is, the schoolmaster has his branches of science, with which, in their details as well as their principles, he ought to be in a thoroughly workmanlike way acquainted. How shall the schoolmaster promptly detect errors in the reasoning of his boys, and skilfully rectify them, but by a thorough study of the art of reasoning, and something like a thorough study of the ratiocinative process generally. And in times when men strike, and masters lock out, to arrange questions of wages, when riots are got up to alter the price of bread, when some legislators will dare propose to tamper with the currency by way of dealing with a panic, or will suggest

the making of railways as a cure for famine; when philanthropists will call upon men in suffering to improve their condition, not by obedience to those great moral laws which social science demonstrates to be as much laws of nature as the law of gravitation itself, but by attention to circumstances merely political, can the schoolmaster offer to take his place with the hope of training up from amongst his boys a race of thoughtful, provident, kind, and self-dependent men, if he have not made this phase of moral science so deep and earnest a matter of study as not merely to have mastered its great principles, but to be promptly skilful in the application in teaching of all its details? Nor may we pass by, far as the time has advanced, the study of the mind, although time does not allow us to say more than that, as the wise architect masters all the details that relate to the strength of the materials he uses, so will the schoolmaster who is at once earnest and intelligent aim at knowing all that may be known—alas! all too little—of how most successfully to treat that which is the main material of his workshop—the mind. And does any one exclaim, Who is sufficient for these things? We answer fearlessly, the intelligent and industrious schoolmaster, and great is the reward of his intelligence and industry. It is no mean thing to be called to a duty which gives such scope and such motives for self-improvement and self-elevation; no mean thing to labour where the results of our labour are so rich, and so always evident as in the school-room and amongst our boys; nor is it a small thing that, at a time like the present, when a great step in social progress is being attempted, that the schoolmaster should be called upon to play his part in the formation of a healthy public opinion, and in promoting the spread of that knowledge and of those habits which, once made general among us, will secure well-being to society and greatness to the nation.

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